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Ma	May 13 1998 10:38:26 rfc2002.txt	Page 1	
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) r =	Herwork Working Group Request: for Comments: 2002	يد بد	
<sub>6</sub> 2	October 1	. 9	
= 2	IP Mobility Support		
2 5	Status of this Memo		
2 2 3	This document specifies an Internet standards track protocol for the		
9 :-	Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the Internet		
E 6 2	Official Protocol Standards* (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited		
27.	Abstract		
53.5	This document specifies protocol enhancements that allow transparent		
5 Z	routing of 1P datagrams to mobile nodes in the Internet. Each mobile	ø	
56	current point of attachment to the Internet. While situated away		
27	from its home, a mobile node is also associated with a care-of		
29	address, Which provides intormation about its current point of attachment to the Internet. The protocol provides for registering		
2 2	the care-of address with a home agent. The home agent sends		
32	ideagrams described for the mobile node through a tunnel to the care- of address. After arriving at the end of the tunnel and date.		
33	is then delivered to the mobile node.		
35	Table of Contents		
3.2	1. Introduction	-	
38	ol Requirements	~ ~	
65	Goals		
41		-	
42	New Architectural Entities		
43	Terminology	2.10	
45	FIGURE OVERVIEW	<b></b>	
46	1.9. Message Format and Protocol Extensibility		
48			
49	2.1.1 Mobility Agent Advertisement Extension		
50	2.1.2. Prefix-Lengths Extension		
52	Agent Solicitation	-	
53	2.3. Foreign Agent and Home Agent Considerations 19		
55	4.3.1. ANVELLISED KOUTER ADDRESSES		
56 57			
28	Perkins Standards Track (Page 1)		

PPC 2002 IP Mobility Support October 1996  2.4. Noble Mode Considerations 2.4. Noble Mode Considerations 2.4. Noble Mode Detection 2.5. Sequence Numbers and Rollover Handling 2.4. Returning New Petersion 3. Registration Overview 3. Registration Overview 3. Registration New Petersion 3. Registration Reply 8 3. Registration Reply 8 3. Sequence Numbers and Rollover Handling 3. Registration Reply 8 3. Sequence Numbers and Rollover Handling 3. Sequence Numbers 9 3. Receiving Registration Requests 9 3. Receiving Registration Repuests 9 4. Receiving Registration Repuests 9 4. Receiving Registration Requests 9 5. Receiving Registration Request 9 5. Receiving Regis	2.3.2 Sequence Numbers and Rollover Handling 2.4. Mobile Node Considerations 2.4.1 Registration Retailed 3. Registration Retailed 3. Registration Returned 3. Registration Reply 3. Registration Request 3.4 Registration Request 3.4 Registration Request 3.5 Authoritoston 3.5.1 Computing Authoritication Extension 3.5.3 Nobile-Poreign Authoritication Extension 3.5.3 Nobile-Poreign Authoritication Extension 3.5.4 Registration Registration Registration 3.5.4 Registration Registration Registration 3.5.5 Receiving Registration Replies 3.6.2 Receiving Registration Replies 3.6.3 Receiving Registration Replies 3.6.3 Receiving Registration Replies 3.7.1 Configuration and Replies 3.7.2 Receiving Registration Replies 3.8 Home Acontiduation and Registration Tables 3.8 Home Acontiduation and Registration 3.9 Receiving Registration Replies 3.8 Home Acontiduation and Registration 3.9 Receiving Registration 3.1 Receiving Registration 3.1 Receiving Registration 3.2 Receiving Registration 3.3 Security Registration 4.2 Receiving Registration 4.3 Security Registration 4.4 Unicast Datagram Routing 4.5 Honels Reputed 4.6 Multicast Datagram Routing 4.7 Multicast Datagram Routing 4.8 Honels Registration 4.9 Honels Registration 4.1 Mobile Routers 4.2 Receiving Registration 4.3 Receiving Registration 4.4 Multicast Datagram Routing 4.5 Honels Routers 5.6 Replay Protection using Timestamps 5.6 Replay Protection using Timestamps 5.6 Replay Protection using Timestamps 6.6 Replay Protection using Timestamps 6.7 Replay Protection using Timestamps 7.6 Replay Protection using Timestamps 7.7 Replay Protection using Timestamps 8.6 Replay Protection using Timestamps 8.7 Replay Protection using Timestamps 8.8 Replay Protection using Timestamps 8.9 Receiving Registration 8.9 Receiving Reg
2.4. Nobile Node Considerations 2.4.1. Registration Required 2.4.2. Move betection 2.4.3. Move betection 3.1. Registration Required 3.4.4. Sequence Numbers and Rollover Handling 3.1. Returning Home 3.1. Returning Home 3.1. Returning Home 3.2. A Mobile The Extension of Sequence Numbers and Rollover Handling 3.3. Angestration Request 3.5. Mobile Home Authentication Extension 3.5. Mobile Home Authentication Extension 3.5. Mobile Home Authentication Request 3.5. Mobile Home Authentication Request 3.5. Mobile Foreign Authentication Request 3.5. Mobile Home Authentication Request 3.5. Receiving Registration Requests 3.6. Sequence Numbers and Registration Tables 3.7. Configuration and Registration Tables 3.7. Configuration and Registration Tables 3.7. Receiving Registration Requests 3.8. Considerations 3.8. Sendiguation and Registration Tables 3.8. Considerations 3.8. Sendiguation and Registration Tables 4.2. Unicasp Latiguate Considerations 4.3. Home Agent Considerations 4.3. Home Agent Considerations 4.4. Multicast Dategrams Routing 4.5. Mobile Routers Tables 5.1. Message Authentication Codes 5.2. Areas of Security Concern in this Protocol 5.3. Areas of Security Concern in this Repeace 5.4. Picky Mangement 5.5. Areas of Security Concern in this Repeace 5.5. Areas of Security Concern in this Repeace 5.6. Areas of Security Concern in this Requests 5.6. Areas of Security Concern in this Repeace 5.6. Areas of Security Concern in this Repeace 5.6. A Replay Protection using Timestamps 6. Acknowledgments 5.6. A Replay Protection using Timestamps 6. Acknowledgments 8. Sequence The Security Concern in this Repeace 8. Security Conc	2.4. Nove Detection 2.4.1 Sequence Numbers and Rollover Handling 2.4.1 Nove Detection 2.4.2 Sequence Numbers and Rollover Handling 3.4.3 Registration Overview 3.1 Registration Overview 3.2 Registration Reply 3.4 Registration Reply 3.5 Registration Reply 3.6 Registration Reply 3.7 Profession Authentication Extension 3.5 Mobile-Porein Authentication Extension 3.6 Nobile Rede Consideration Replies 3.7 Receiving Registration Replies 3.7 Receiving Registration Replies 3.7 Receiving Registration Replies 3.7 Receiving Registration Replies 3.8 Home Apent Considerations 3.8 1.2 Receiving Registration Replies 3.8 Home Apent Considerations 4.1 Receiving Registration Replies 3.8 Anniconsiderations 4.2 Receiving Registration Replies 4.2 Unicast Detegram Routing 4.3 Receiving Registration Replies 4.2 Unicast Detegram Routing 4.3 Receiving Registration Replies 4.2 Unicast Detegram Routing 4.3 Receiving Registration Replies 5.8 Receiving Registration Replies 4.2 Unicast Detegram Routing 4.3 Receiving Registration Replies 5.8 Receiving Registration Replies 5.8 Receiving Registration Replies 6.9 Receiving Registration Replies 6.0 Receiving Registration Replies 6.1 Receiving Registration Replies 6.2 Receiving Registration Replies 6.3 Receiving Registration Replies 6.4 Receiving Registration Replies 6.5 Receiving Registration Replies 6.6 Replay Protection Unsing Vinestamps 6.7 Receiving Registration Sequence 6.8 Resplay Protection using Timestamps 6.6 Replay Protection using Timestamps 6.7 Replay Protection using Monces 6.8 Replay Protection using Monces 6.9 Replay Protection using Monces 7 Receiving Registration Replay Protection using Replay Profession Replay Profession Using Replay Profession Replay Pr
2.4 wobile wode Commercations 2.4 wobile wode Considerations 2.4.1 Registration Required 3.4.1 Registration Required 3.4.1 Registration Proceeding 3.5.4 New Detection 3.5.4 Negistration Reply 3.5.4 Computing Authentication Extension 3.5.4 Poteign-Home Authentication Extension 3.5.5 Receiving Registration Replies 3.6.3 Registration and Registration Tables 3.7.1 Configuration and Registration Tables 3.7.2 Receiving Registration Replies 3.8 Home Agent Considerations 4.2 Poteign-Home Authentication 4.3 Security Registration Replies 4.4 Multicat Datagrams Routing 4.5 Mobile Routers 4.6 Management 4.6 Mathematematication Considerations 4.7 Means of Security Concern in this Protocol 5.5 Poteign Adent Considerations 4.6 Means Registration Freeding Proceeding Proceedin	2.4 while Node Considerations 2.4.1 Registration Required 3.4.1 Registration Required 3.4.3 Neve Detection 3.4.4 Registration Repeat 3.4.4 Registration Repeat 3.5 Registration Reply 3.5 Authoritoation 3.5.4 Computing Authoritication Extension Values 3.5.2 Nobile-fore Authoritication Extension 3.5.3 Nobile-fore Authoritication Extension 3.5.4 Nobile-fore Authoritication Replies 3.5.7 Receiving Registration Replies 3.6 Nobile-fore Authoritication Replies 3.7.1 Receiving Registration Replies 3.7.2 Receiving Registration Requests 3.8.1 Configuration and Registration Tables 3.8.2 Receiving Registration Replies 3.9.3 Security Considerations 3.8.3 Sending Registration Replies 4.1 Enceptual Authoritication 4.2 Excerting Registration Replies 4.2 Unicast Datagram Routing 4.3 Excerting Registration Replies 4.4 Nouting Considerations 4.2 Home Agent Considerations 5.4 Nouting Considerations 6.5 Nobile Routers 6.5 Nobile Routers 6.6 Nobile Routers 6.6 Nobile Routers 6.7 Replay Protection ocdes 6.7 Replay Protection using Timestamps 6.8 Replay Protection using Timestamps 6.9 Replay Protection using Track 6.1 Replay Protection using Track 6.2 Replay Protection using Track 6.3 Replay Protection using Track 7.4 Revenue Replay Protection using Track 8.5 Replay Protection using Track 8.6 Replay Protection using Track 9.7 Replay Protection using Track 9.8 Replay Protection using Track 9.9 Replay R
2.4.1 Registration Required 2.4.2 Nove Detection 2.4.3 Returning Home 2.4.3 Registration (Nover) 3.1.3 Authorication Overview 3.2.4 Registration Reply 3.2.4 Registration Reply 3.5.4 Registration Reply 3.5.4 Registration Reply 3.5.4 Registration Returns 3.6.4 Registration Replies 3.7.2 Receiving Registration Replies 3.7.2 Receiving Registration Replies 3.7.2 Receiving Registration Replies 3.8.1 Receiving Registration Replies 3.9.2 Receiving Registration Replies 3.9.3 Sending Registration Replies 4.1 Encapsulation Types 4.2 Noteign Agent Considerations 4.3. Sending Registration Replies 4.4 Unicas Badagram Routing 4.2. Foreign Agent Considerations 4.3. Howe Agent Considerations 4.4 Noteign Agent Considerations 5.8.2 Receiving Registration Replies 4.4 Noteign Agent Considerations 5.8.4 Nobile Routers 5.5 Resident Routing 5.5 Resident Routing 6.5 Resident Routing 6.6 Action Agent Considerations 6.6 Action Independent Concern in this Protocol 6.7 Resident Routing 6.8 Resident Routing 6.9	2.4.1. Registration Required 2.4.3. Requester Numbers and Rollover Handling 2.4.3. Returning Home 2.4.3. Returning Home 2.4.4. Sequence Numbers and Rollover Handling 2.4.4. Sequence Numbers and Rollover Handling 2.4.4. Registration Overview 2. Authoritication 2. Authoritication 3. Registration Regulat 3. S. Mobile Home Authoritication Extension 3. S. Mobile Home Registration Requests 3. S. Receiving Registration Replies 3. Sending Registration Requests 3. S. Receiving Registration Replies 3. Sending Registration Replies 3. Sending Registration Replies 3. Sending Registration Replies 3. Sending Registration Replies 4. S. Foreign Adent Considerations 5. Mobile Routers 5. Areas of Security Concern in this Protocol 5. Areas of Security Concern in this Protocol 5. Areas of Security Concern in this Protocol 6. ARP Proxy ARP and Gracuitous ARP 6. Security Considerations 6. ARP Proxy ARP 7. Security Considerations 6. ARP Proxy ARP 8. Areas of Security Concern in this Protocol 8. Replay Protection for Registration Requests 5. G. Replay Protection using Timestamps 5. G. Replay Protection using Timestamps 6. S. Replay Protection using Timestamps 7. S. Registration Redisers 8. S. Registration Registration Requests 8. S. Registration Registration Registers 8. S. Registration Registration Registration Registers 9. S. Registration Registration Registration Registers 9. S. Regis
2.4.2. Nove Detection 2.4.3. Editurning home 3.4.3. Registration overview 3.1. Registration overview 3.2. Authentication 3.3. Registration Request 3.4. Registration Reply 3.5. Computing Authentication Extension 3.5. Nobile-foreign withentication Extension 3.5. Nobile-foreign withentication Extension 3.5. Nobile-foreign withentication Extension 3.5. Nobile-foreign withentication Extension 3.5. Nobile-foreign midming extension 3.5. Nobile-foreign midming registration Replies 3.5. Nobile-foreign midming registration Replies 3.5. Receiving Registration Replies 3.7. Receiving Registration Replies 3.7. Receiving Registration Replies 3.7. Receiving Registration Replies 3.7. Receiving Registration Replies 3.8. Home Agent Considerations 4.2. Mouting Considerations 4.2. Mouting Considerations 4.2. Notice Detection Registration Replies 4.2. Hone Agent Considerations 4.2. Union Agent Considerations 4.3. Receiving Registration Replies 4.4. Multicast Detegram Routing 4.5. Multicast Detegram Routing 4.5. Multicast Detegram Routing 4.6. Multicast Detegram Routing 5.5. Reserving Considerations 5.6. Meas Amagement Considerations 5.6. Meas Amagement Considerations 5.6. Meas Amagement Considerations 5.6. Meas Amagement Considerations 5.7. Resplay Protection using Timestamps 5.6. Replay Protection using Timestamps 6.6. Acknowledgments 8.8. Replay Protection using Timestamps 8.9. Replay Protection	2.4.3. Nove Detection 2.4.4. Sequence Numbers and Rollover Handling 3. Registration 3.1. Registration Overview 3.1. Registration Request 3.4. Registration Request 3.5. Registration Request 3.6. Registration Request 3.6. Nobile Hone Authentication Extension 3.5. Nobile Hone Authentication Extension 3.5. Registration Reply 3.5. Receiving Negistration Retension 3.6. Nobile Hone Authentication Extension 3.6. Receiving Registration Reples 3.6. Receiving Registration Reples 3.7. Receiving Registration 3.8. Home Agent Considerations 4.2. Porting Considerations 4.2. Porting Adent Considerations 4.2. Home Agent Considerations 4.3. Home Agent Considerations 5. Receiving Registration Requests 5. Receiving Registration Requests 5. Receiving Registration Requests 6. Anniticast Datagram Routing 6. Howe Agent Considerations 6. Ample Routest Datagram Routing 6. Map Procy ARP, and Gratuitous ARP 6. Amp Procy ARP, and Gratuitous ARP 6. Areas of Security Concern in this Prococol 6. Acknowledgments 6. Acknowledgments 6. Acknowledgments 6. Acknowledgments 7. Replay Protection using Timestamps 6. Acknowledgments 7. Replay Protection using Track 7. Registration Requests 7. Replay Protection using Prococol 7. Replay Protection using Prococol 8. Replay Protection Using Replay Protection Using Replay Prococol 8. Replay Protection Replay Prot
2.4.3 Requiring Homes 3. Registration Squence Numbers and Rollover Handling 3.1. Authentication 3.2. Authentication 3.2. Authentication 3.2. Authentication 3.3. Registration Request 3.4. Registration Reply 3.5. In Computing Authentication Extension 3.5. Locapuling Authentication Extension 3.5. Locapuling Authentication Extension 3.5. Nobile-lowe Authentication Extension 3.5. Nobile-lowe Authentication Extension 3.5. Nobile-lowe Authentication Extension 3.5. Nobile-lowe Authentication Returning 3.5. Social Registration Replies 3.5. Registration Returning 3.5. Registration Returning 3.7. Configuration and Registration Tables 3.7. Receiving Registration Replies 3.7. Receiving Registration Replies 3.7. Receiving Registration Replies 3.8. Seading Registration Replies 3.8. Seading Registration Replies 4.2. Receiving Registration Replies 4.2. Notifie Rode Considerations 4.3. Home Agent Considerations 4.3. Home Agent Considerations 5. Rey Multicast Datagram Routing 4.4. Multicast Datagram Routing 4.5. Mobile Rodes Considerations 5. Resease Authentication Godes 5. Arease of Security Concern in this Protocol 5. Replay Protection for Registration Requests 5. Resease Authentication Codes 5. Replay Protection using Timestamps 5. Replay Protection using Timestamps 6. Replay Protection using Timestamps 6. Replay Protection using Timestamps 7. Receiving Registration using Timestamps 8. Rehandedments 8.	2.4.1. Returning Home 3. Registration 3.1. Registration Overview 3.1. Authentication 3.2. Authentication 3.3. Registration Request 3.3. Registration Request 3.4. Registration Revensions 3.5. Registration Extensions 3.5. Mobile Home Authentication Extension 3.5. Mobile Home Authentication Extension 3.5. Mobile Home Authentication Extension 3.6. Sending Registration Requests 3.6. Sending Registration Replies 3.6. Receiving Registration Replies 3.6. Receiving Registration Replies 3.7. Toreign Agent Considerations 3.7. Receiving Registration Replies 3.8. Sending Registration Replies 3.8. Sending Registration Replies 3.8. Sending Registration Replies 4.1. Encapsulation Types 4.2. Foreign Agent Considerations 4.2. Foreign Agent Considerations 4.2. Foreign Agent Considerations 4.2. Foreign Agent Considerations 4.3. Home Agent Degram Routing 4.5. Mobile Routers 5. Security Considerations 6. Mobile Routers 5. Security Considerations 6. Message Authentication Codes 5. Active Good Random Numbers 5. Security Considerations 6. Resplay Protection using Vinestangs 6. Acknowledgments 6. Acknowledgments 7. Replay Protection using Timestangs 6. Acknowledgments 7. Replay Protection using Timestangs 6. Acknowledgments 7. Replay Protection using Track 7. Resplay Protection using Track 8. Resplay Protection Using Track 8
3. Registration overview 3. Registration overview 3. Registration overview 3. Registration overview 3. Registration Repuest 3. Registration Repuest 3. S. Authentication Extension Values 3. S. Mobile-form Authentication Extension 3. S. Mobile-form Registration Replies 3. S. Mobile-form Registration Replies 3. S. Registration Replies 3. S. Registration Replies 3. T. Poreign Registration Replies 3. T. Deceiving Registration Replies 3. S. Registration and Registration Tables 3. S. Registration Replies 3. Registration Replies 3. S. Reding Registration Replies 3. S. Receiving Registration Replies 3. S. Receiving Registration Replies 4. Encepasulation Types 4. S. Receiving Registration Replies 4. Unicast Datagram Routing 4. S. Poreign Adent Considerations 4. Multicast Datagram Routing 5. Registration Types 5. Foreign Agent Considerations 5. Map Proxy App and Grautitous App 5. Security Considerations 5. Messes Authentication Codes 5. Replay Protection using Timestamps 5. Fixing Good Random Numbers 5. S. Pring Good Random Numbers 5. S. Pring Good Random Numbers 5. Replay Protection using Timestamps 6. Acknowledgments 7. Security Consideration using Timestamps 7. S. Poreign Registration Unity Registration Requests 7. S. Replay Protection using Timestamps 8. S. Schowledgments 8. S. Registration Security Consideration using Timestamps 8. S. Schowledgments 8. S. Registration Security Consideration using Timestamps 8. S. Registration Security Consideration using Timestamps 8. S. Registration Unity Security Consideration using Timestamps 8. S. Schowledgments 8. S. Sch	3. Registration 3. 1. Registration Overview 3. 1. Registration Overview 3. 2. Authentication 3. 2. Registration Request 3. Registration Extensions 3. 3. Registration Extensions 3. 5. 2. Mobile Home Authentication Extension 3. 5. 3. Mobile Home Authentication Extension 3. 5. 4. Portagn-Home Authentication Extension 3. 6. 1. Sending Registration Reguests 3. 6. 1. Sending Registration Requests 3. 7. Portagn Agent Considerations 3. 7. Portagn Agent Considerations 3. 8. 2. Receiving Registration Requests 3. 8. 1. Configuration and Registration Tables 3. 8. 2. Receiving Registration Requests 3. 8. 2. Receiving Registration Requests 4. 1. Mobile Node Considerations 4. 2. 1. Home Agent Considerations 4. 2. 1. Home Agent Considerations 4. 3. Bradicast Datagram Routing 4. 2. 1. Home Agent Considerations 4. 3. Bradicast Datagram Routing 4. 5. Mobile Routers Datagram Routing 4. 5. Mobile Routers Datagram Routing 4. 5. Mobile Routers Datagram Routing 5. 5. Erivagn Authentication Concern in this Protocol 5. 6. Areas of Security Concern in this Protocol 5. 7. Ress of Security Concern in this Protocol 5. 6. Replay Protection using Nances 5. 6. 1. Replay Protection using Nances 5. 6. 1. Replay Protection using Nances 6. Acknowledgments 8. 8. 1. Mobile Routers 8. 6. 2. Replay Protection using Nances 8. 6. Acknowledgments 8. 8. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10
3. Authentication 3. Authentication 3. Authentication 3. Segistration Request 3. Aregistration Request 3. Segistration Request 3. Computing Authentication Extension 3. S. Computing Authentication Extension 3. S. Computing Authentication Extension 3. S. A Poreign-Home Authentication Extension 3. Second Considerations 3. Second Registration Replies 3. S. A Receiving Registration Replies 3. J. A Receiving Registration Replies 4. J. Honel Agent Considerations 4. J. Honel Agent Considerations 4. J. Honel Agent Considerations 4. Sending Registration Replies 4. J. Honel Agent Considerations 4. Sending Registration Replies 4. Multicast Dategram Routing 5. Areas of Security Concern in this Protocol 5. Areas of Security Concern in this Protocol 5. Areas of Security Concern in this Protocol 5. Areas of Security Concern in Sequests 5. Pricking Good Random Numbers 5. Pricking Good Random Numbers 5. Replay Protection ior Registration Requests 5. Replay Protection using Timestamps 5. Acknowledgments 6. Acknowledgments 7. Replay Protection using Timestamps 7. Security Considerations 8. Security Considerations 8. Security Considerations 8. Security Consideration 8. Security Consideration 8. Security Consideration 8. Security Consideration 9. Security Conside	3. Authentication 3. Authentication 3. Authentication 3. Registration Request 3. Segistration Request 3. Segistration Reguest 3. Computing Authentication Extension 3. Segistration Extensions 3. Segistration Extension 3. Selfond Registration Requests 3. Selfond Registration Requests 3. Selfond Registration Requests 3. Selfond Registration Requests 3. Selfond Registration Replies 3. Secion Registration Replies 3. Secion Registration Replies 3. Secion Registration Replies 3. To Receiving Registration Replies 3. To Receiving Registration Replies 3. To Receiving Registration Replies 3. Secion Registration Replies 3. Secion Registration Replies 4. Unicast Detagram Routing 4. Secion Types 4. Unicast Detagram Routing 5. Security Considerations 6. Message Authentication Codes 5. Message Authentication Codes 5. Message Authentication Codes 5. Areas of Security Concern in this Protocol 5. Replay Protection using Vimestamps 6. Replay Protection using Vimestamps 6. Replay Protection using Vimestamps 6. Revinal Edgments 7. Replay Protection using Vimestamps 7. Revinal Registration Requests 5. Security Registration Requests 5. Security Considerations 6. Replay Protection using Vimestamps 7. Replay Protection using Vimestamps 7. Revinal Registration Requests 7. Replay Protection using Vimestamps 8. Security Registration Requests 8. Security Registration Requests 8. Security Registration Requests 8. Security Registration Registration Requests 8. Security Registration
1. Registration Overview 1. Registration Overview 1. Registration Request 1. Registration Reply 1. S. Registration Reply 1. S. Registration Reply 1. S. Lomputing Authentication Extension 1. S. Mobile Howe Authentication Extension 1. S. Mobile Howe Authentication Extension 1. S. Mobile Howe Authentication Extension 1. S. Howele Considerations 1. Sectiving Registration Registration Replies 1. Sectiving Registration Replies 1. Receiving Registration Requests 1. Receiving Registration Requests 1. Receiving Registration Codes 1. Residest Datagram Routing 1. Mobile Routers Datagram Routing 1. Message Authentication Codes 1. Resident Datagram Routing 1. Resident Datagram Routing 1. Ressage Authentication Codes 1. Ressage Authentication Codes 1. Resplay Protection using Nonces 1. Replay Protection using Nonces 1. Reckins 1. Resplay Protection using Nonces 1. Reckins 1. Resplay Protection using Nonces 1. Reckins 1. Resplay Protection using Requests 1. Resplay Protection using Registration Requests 1. Resplay Registration Registration Requests 1. Resplay Registration Registration Registration Registration Registration Registration Registration Registration Registration Regist	3.2. Registration Overview 3.3. Registration Neguest 3.4. Registration Reply 3.5. Registration Reply 3.5. Registration Reply 3.5. Registration Reply 3.5. Registration Extensions 3.5.1. Computing Authentication Extension 3.5.3. Wobile-Home Authentication Extension 3.5.4. Nobile-Home Authentication Extension 3.6.1. Sending Registration Requests 3.6.1. Sending Registration Replies 3.6.1. Sending Registration Replies 3.7. Receiving Registration Replies 3.8. Sending Registration Replies 3.8. Sending Registration Replies 3.8. Sending Registration Replies 4.1. Mobile Node Considerations 4.2. Home Agent Considerations 4.2. Home Agent Considerations 4.3. Mobile Routers 4.4. Multicast Datagram Routing 4.5. Mobile Routers 5.1. Message Authentication Codes 5.2. Areas of Security Concern in this Protocol 5.3. Key Management 5.4. Mobile Routers 5.5. Privacy 5.6. Replay Protection using Nances 5.7. Replay Protection using Nances 5.8. Acknowledgments 5.9. Replay Protection using Nances 5.1. Replay Protection using Nances 5.2. Replay Protection using Timestamps 5.3. Replay Protection using Timestamps 5.4. Replay Protection using Timestamps 5.5. Replay Protection using Timestamps 5.6. Replay Protection using Timestamps 6.7. Replay Protection using Timestamps 7. Replay Protection Using Timestamps 8. Replay Protection Using Timestamps
3.4. Authentication 3.5. Authentication 3.5. Registration Request 3.5. Computing Authentication Extension 3.5. Mobile Home Authentication Extension 3.5. Mobile Home Authentication Extension 3.5. Mobile Home Authentication Extension 3.6. Mobile Home Authentication Extension 3.6. Receiving Registration Requests 3.6. Receiving Registration Requests 3.6. Receiving Registration Replies 3.7. Receiving Registration Replies 3.7. Receiving Registration Replies 3.7. Receiving Registration Replies 3.7. Receiving Registration Replies 3.8. Configuration and Registration Tables 3.8. Configuration and Registration Tables 3.8. Sending Registration Replies 4.2. Unicast Detagrams touting 4.2. Mobile Routers 4.2. Foreign Agent Considerations 4.3. Broadcast Detagrams Routing 4.4. Multicast Detagrams Routing 4.5. Mobile Routers 5. Security Considerations 4.6. ARP Procy ARP, and Gratuitous ARP 5. Security Considerations 6. Mobile Routers 5. Security Concern in this Protocol 5. Message Authentication Codes 5. Message Authentication for Registration Requests 5. Rey Management Considerations 6. Acknowledgments 6. Acknowledgments 6. Acknowledgments 7. Replay Protection using Timestamps 6. Acknowledgments 8. C. Replay Protection using Timestamps 8. C. Replay Protection using Track 8. Acknowledgments 8. C. Replay Protection using Track 8. Acknowledgments 8. C. Replay Protection using Track 8. Acknowledgments 8. Acknowledgme	3.3. Registration Request 3.4. Registration Request 3.5. Registration Request 3.5. Registration Reply 3.5. Computing Authentication Extension 3.5.1 Wobile-fore with Authentication Extension 3.5.4 Wobile-fore with Authentication Extension 3.5.4 Foreign-Heme Authentication Extension 3.5.4 Foreign-Heme Authentication Extension 3.5.4 Foreign-Heme Authentication Extension 3.5.4 Foreign Registration Requests 3.6.1 Registration Requests 3.6.2 Receiving Registration Requests 3.7. Exceiving Registration Requests 3.7. Receiving Registration Requests 3.7. Receiving Registration Requests 3.8.1. Configuration and Registration Tables 3.9. Receiving Registration Requests 3.9. Receiving Registration Requests 3.9. Configuration Registration 3.9. Receiving Registration 4.2. Receiving Registration 4.2. Receiving Registration 4.2. Foreign Agent Considerations 5. Mobile Requests 5. Receiving Registration Replies 5. Manifesst Datagram Routing 4.5. Mobile Reduces 5. Mobile Reduces 5. Manifesst Datagram Routing 5. Manifesst Datagram Routing 6. Replay Proceedion for Registration Requests 5. Areas of Secutity Concern in this Protocol 5. Measurement 5. Measurement 5. Measurement 5. Replay Protection using Timestamps 5. G. Replay Protection using Monces 5. Replay Protection using Monces 5. Replay Protection using ming Timestamps 5. S. Replay Protection using Monces 5. S. Replay Protection using Manifes
1.4. Replateration Request 3.4. Replateration Repust 3.5. Replateration Repust 3.5. Replateration Exernation 3.5. Mobile Hower Authentication Extension 3.6. Mobile Foreign Authentication Extension 3.6. Mobile Foreign Authentication Extension 3.6. Mobile Foreign Authentication Extension 3.6. Mobile Mode Considerations 3.6. Receiving Registration Replates 3.7. Receiving Registration Replates 3.7. Receiving Registration Repusts 3.8. Home Agent Considerations 3.8. Home Agent Considerations 3.8. Home Agent Considerations 4.2. Mobile Mode Considerations 4.2. Mobile Rouders Datagram Routing 4.2. Mobile Routers Datagram Routing 4.3. Home Agent Datagram Routing 4.4. Multicast Datagram Routing 4.5. Mobile Routers Datagram Routing 5. Receiving Registration Requests 5. Resadest Datagram Routing 4.5. Mobile Routers 5. Resadest Datagram Routing 5. Resadest Datagram Routing 5. Resadest Datagram Routing 6. Homely Routers 6. Security Considerations 6. Security Considerations 6. Resplay Protection using Nonces 6. Acknowledgments 6. Acknowledgments 6. Replay Protection using Primestamps 6. Acknowledgments 7. Replay Protection using Monces 7. Replay Protection using Primestamps 8. Replay Protection using Protection using Protection using Primestamps 8. Replay Protection Using Replay Protection Replay Protection Replay Protection Replay Protection Replay Protection Replay Protection Replay Pro	3.4 Registration Request 3.5 Registration Reply 3.5 Registration Extension Stepsions 3.6.1 Computing Authentication Extension 3.6.2 Mobile-found Authentication Extension 3.6.3 Mobile-found Muthentication Extension 3.6.1 Sending Registration Replies 3.6.2 Receiving Registration Replies 3.6.3 Registration Replies 3.7.1 Configuration and Registration Tables 3.7.2 Receiving Registration Replies 3.7.3 Receiving Registration Replies 3.7.3 Receiving Registration Replies 3.8.1 Configuration and Registration Tables 3.8.2 Receiving Registration Replies 3.8.3 Configuration and Registration Pables 3.8.1 Configuration and Registration Replies 4.1. Encapsulation Types 4.2. Receiving Registrations 4.3. Hone Agent Considerations 5. Hone Agent Considerations 5. Hone Agent Considerations 6.3. Hone Agent Considerations 6.4. Hone Proxy ARP and Gratuitous ARP 6.5. Hone Proxy ARP and Gratuitous ARP 6.5. Hone Agent Proxy Agent Agen
1.4. Registration Extensions 3.5. Computing Authentication Extension Values 3.5.1. Computing Authentication Extension 3.5.2. Mobil- Hone Authentication Extension 3.5.4. Mobil- Hone Authentication Extension 3.5.4. Mobile Proreign Authentication Extension 3.6. Mobile Node Considerations 3.6. Receiving Registration Requests 3.6. Receiving Registration Requests 3.7. Receiving Registration Replies 3.7. Receiving Registration Replies 3.7. Receiving Registration Replies 3.7. Receiving Registration Replies 3.8. Configuration and Registration Tables 3.8. Receiving Registration Replies 4.1. Encepsulation Types 4.2. Honeysulation Types 4.2. Foreign Agent Considerations 4.3. Sending Registration Replies 4.4. Mouting Considerations 4.2. Hobelle Node Considerations 4.3. Broadvast Datagram Routing 4.3. Broadvast Datagram Routing 4.3. Honeysulation Types 4.5. Mobile Routes 5. Security Considerations 6. Mossage Authentication Codes 5. Message Authentication Codes 5. Message Authentication Codes 5. Message Authentication of Registration Requests 5. Revers of Security Concern in this Protocol 5. Privacy 5. Replay Protection using Nameses 6. Acknowledgments 6. Acknowledgments 7. Replay Protection using Nameses 6. Acknowledgments 7. Replay Protection using Track 8. Replay Protection using Track 9. Replay Protection Usin	3.4 Registration Replay 3.5. Registration Retensions 3.5. Registration Extension 3.5. Registration Extension 3.5.1 Mobile-Foreign Authentication Extension 3.6. Wobile-Home Authentication Extension 3.6. Wobile-Home Authentication Extension 3.6. Registration Requests 3.6. Registration Requests 3.6. Registration Requests 3.6. Receiving Registration Requests 3.7. Configuration Retransmission 3.7. Receiving Registration Replies 3.7. Receiving Registration Replies 3.7. Receiving Registration Replies 3.8. Nome Agent Considerations 3.9. Receiving Registration Replies 3.9. Receiving Registration Replies 3.9. Receiving Registration Replies 3.9. Receiving Registration Replies 3.9. Configuration Paper 3.9. Seceiving Registration Replies 4.2. Mobile Node Considerations 4.2. Foreign Agent Considerations 4.2. Foreign Agent Considerations 4.2. Foreign Agent Considerations 4.2. Multicast Datagram Routing 4.3. Multicast Datagram Routing 5. Security Considerations 5. Measures 5. Management Considerations 5. Management Consideration Replies 5. Security Considerations 5. Management Consideration Replies 5. Security Consideration Replies 5. Areas of Security Concern in this Protocol 5. Areas of Security Concern in this Protocol 5. Areas of Security Concern in this Protocol 5. Areas of Security Concern using Timestamps 5. G. I. Replay Protection in using Timestamps 5. G. I. Replay Protection using Mances 5. G. Replay Protection using Naces 5. G. Replay Protection using Mances 5. G. Replay Protection using Mances 5. S. Reylay Replay Protection using Mances 6. Replay Protection using Mances 7. Reylay Replay Protection using Mances 8. Reylay Replay Protection using Mances 8. Reylay Protection using Mances 8. R
1.5. Registration Extensions 3.5. Mobile-Home Authentication Extension 3.5. Mobile-Home Authentication Extension 3.6. Mobile-Home Authentication Extension 3.6. Mobile-Home Authentication Extension 3.6. Seclain Registration Registration Extension 3.6. Seclain Registration Replies 3.6. Receiving Registration Replies 3.7. Receiving Registration Replies 3.8. Receiving Registration Replies 3.8. Sending Registration Replies 3.8. Sending Registration Replies 4. Exceeving Registration Replies 4. Exceeving Registration Replies 4. Exceeving Registration Replies 4. Mome Agent Considerations 4. Exceeving Registration Replies 4. Mobile Node Considerations 4. Mobile Routers 4. Mobile Routers 5. Mobile Routers 5. Mobile Routers 6. Mobile Routers 7. Message Authentication Codes 5. Message Authentication Codes 5. Rese of Security Concern in this Protocol 5. Message Authentication Codes 5. Replay Protection using Nances 6. Acknowledgments 8. Standards Track 8. Replay Protection using Timestamps 8. Serving Registration Requests 8. Serving Registration Requests 9. Replay Protection using Timestamps 8. Acknowledgments 8. Replay Protection using Timestamps 8	1.5. Registration Extensions 3.5.1. Computing Authentication Extension 3.5.2. Wobile-Home Authentication Extension 3.5.2. Wobile-Home Authentication Extension 3.5.3. Wobile-Home Authentication Extension 3.5.4. Foreign-Home Authentication Extension 3.6.1. Sending Registration Replies 3.6.1. Sending Registration Replies 3.6.2. Receiving Registration Replies 3.7.1. Configuration and Registration Tables 3.7.2. Receiving Registration Replies 3.7.3. Receiving Registration Replies 3.7.3. Receiving Registration Replies 3.8.1. Configuration and Registration Tables 3.8.1. Sending Registration Replies 3.8.3. Sending Registration Replies 4.2. Receiving Registration Replies 4.2. Foreign Agent Considerations 4.3. Broaders Datagram Routing 4.4. Multicast Datagram Routing 4.5. Mobile Routers 5. Goverity Consideration Codes 5.1. Message Authentication Codes 5.1. Message Authentication Codes 5.2. Areas of Security Concern in this Protocol 5.3. Rey Management 5.4. Picking Code Random Numbers 5.5. Privacy 5.6. Replay Protection using Nances 5.7. Replay Protection using Nances 5.8. Replay Protection using Nances 5.9. Replay Protection using Nances 5.6. Replay Protection using Nances 5.7. Replay Protection using Nances 5.8. Replay Protection using Nances 5.9. Replay Protection Registration Using Nances 5.9. Replay Protection Registration Using Nances 5.9. Replay Protection Registration Using Nances 6.9. Replay Protection Registration Using Nances 6.9. Replay Protection Registration Registration Registration Registration Registration Registration Registration
3.5.1. Computing Authentication Extension of Science of	3.5.1. Computing Authentication Extension 3.5.1. Mobile-Foreign Authentication Extension 3.5.3. Wobile-Foreign Authentication Extension 3.5.3. Wobile-Foreign Authentication Extension 3.5.3. Wobile-Foreign Authentication Extension 3.5.3. Wobile Note Considerations 3.6.1. Sending Registration Requests 3.6.1. Sending Registration Requests 3.6.3. Registration Requests 3.7. Receiving Registration Requests 3.7. Receiving Registration Requests 3.7. Receiving Registration Requests 3.7. Receiving Registration Replies 3.8. None Agent Considerations 3.8. Sending Registration Replies 3.8. Roming Registration Replies 3.8. Roming Registration Replies 3.8. Roming Registration Replies 4.1. Configuration and Registration Replies 4.2. Incomiderations Note Considerations 4.3. Honoriderations Note Considerations 4.3. Honoriderations Routing 4.2. Hobile Node Considerations 4.3. Honoriderations Routing 4.2. Hobile Routers 4.4. Multicast Datagram Routing 4.3. Honorideration Codes 4.4. Multicast Datagram Routing 5. Security Considerations 6.3. Honorideration Codes 6.3. Honorideration Codes 6.4. Replay Protection Using Timestamps 5. Security Consideration 8.3. Honorideration 8.3. Honoriderati
3.5.2 Mobile-Hone Authentication Extension 3.5.4 Poreign-Home Authentication Extension 3.5.4 Poreign-Home Authentication Extension 3.5.4 Poreign-Home Authentication Extension 3.6.1 Sending Registration Replies 3.6.2 Receiving Registration Replies 3.7.1 Configuration Replies 3.7.2 Receiving Registration Replies 3.7.3 Receiving Registration Replies 3.8.1 Configuration and Registration Tables 3.8.1 Configuration and Registration Tables 3.8.2 Receiving Registration Replies 3.8.3 Routing Considerations 4.1 Encapsulation Types 4.2 Unicast Datagram Routing 4.2.1 Mobile Node Considerations 4.2.1 Mobile Node Considerations 4.3.1 Home Agent Considerations 4.3.1 Home Agent Considerations 4.3.2 Receiving Registration Replies 4.2 Unicast Datagram Routing 4.3.1 Home Agent Considerations 4.3 Mobile Routers 4.4 Multicast Datagram Routing 4.5 Mobile Routers 5.6 Mobile Routers 5.7 Areas of Security Concern in this Protocol 5.3 Areas of Security Concern in this Protocol 5.4 Message Authentication Codes 5.5 Areas of Security Concern in this Protocol 5.5 Areas of Security Concern in this Protocol 5.6 Replay Protection for Registration Requests 5.6 Replay Protection for Registration Requests 5.6 Replay Protection using Timestamps 5.6 C.2 Replay Protection using Timestamps 5.7 Revented Temperature Temperatur	3.5.2 Mobile-Home Authentication Extension 3.5.3 Mobile-Home Authentication Extension 3.6. Mobile Foreign Authentication Extension 3.6. Mobile Note Considerations 3.6.1. Sending Registration Requests 3.6.2. Receiving Registration Requests 3.7. Receiving Registration Replies 3.7. Receiving Registration Replies 3.7.3. Receiving Registration Replies 3.7.3. Receiving Registration Replies 3.7.3. Receiving Registration Replies 3.7.3. Receiving Registration Replies 3.8.1. Configuration and Registration Tables 3.8.1. Configuration and Registration Tables 3.8.1. Configuration and Registration Replies 4.1. Unicast Datagram Routing 4.2. Mobile Routers 4.2. Mobile Routers 4.2. Mobile Routers 4.3. Homb Agent Considerations 4.4. Mobile Routers 5.4. Mobile Routers 5.4. Mobile Routers 5.5. Meas of Security Concern in this Protocol 5.3. Areas of Security Concern in this Protocol 5.3. Areas of Security Concern in this Protocol 5.4. Replay Protection Gor Registration Requests 5.5. Privacy 5.6. Replay Protection using Timestamps 5.6. Replay Protection using Nonces 6. Acknowledgments 8. Replay Protection using Nonces 8. Replay Protection Using Nonces 8. Replay Protection Replay Replay Protection Replay Replay Protection Replay Replay Protection Replay Replay Replay Protection Replay Replay Replay Protection Replay Repla
3.5.3 Wobile-Foreign Authentication Extension 3.6. Wobile Node Considerations 3.6. Mobile Node Considerations 3.6.1 Serining Registration Requests 3.6.1 Receiving Registration Requests 3.6.3 Receiving Registration Requests 3.7.1 Configuration and Registration Tables 3.7.2 Receiving Registrations 3.7.3 Receiving Registrations 3.8.1 Nome Agent Considerations 3.9.2 Receiving Registration Requests 3.8.1 Configuration and Registration Tables 3.8.2 Receiving Registration Requests 3.8.3 Sending Registration Replies 4.1. Enclayulation Types 4.2. Unicast Datagrams Routing 4.2. Foreign Agent Considerations 4.2. Foreign Agent Considerations 4.2. Foreign Agent Considerations 4.3. Multicast Datagrams Routing 5. Security Considerations 5. Meass of Security Concern in this Protocol 5.3 Areas of Security Concern in this Protocol 5.4 Areas of Security Concern in this Protocol 5.5 Areas of Security Concern using Timestamps 5. Security Considerations 5. Helpay Protection for Registration Requests 5. Areas of Security Concern using Nances 5. Areas of Security Concern using Nances 5. Areas of Security Concern using Nances 5. Areas of Security Concern using Timestamps 5. Security Considerations 5. Areas of Security Concern using Nances 5. Areas of Security Concern using Nances 5. Areas of Security Concern using Nances 5. Areas of Security Considerations 5. Areas of Security Concern using Nances 6. Arenowledgments 7. Replay Protection using Nances 7. Areas of Security Concern using Nances 8. Areas of Security Concern using Nances 9. Areas	3.6. Mobile Horeign Authentication Extension 3.5. Mobile Node Considerations 3.6. Poreign Hode Considerations 3.6. Seceiving Registration Requests 3.6. S. Receiving Registration Requests 3.7. Poreign Agent Considerations 3.7. Receiving Registration Requests 3.7. Receiving Registration Requests 3.8. Home Agent Considerations 3.8. Home Agent Considerations 3.8. Receiving Registration Requests 3.8. Receiving Registration Repulses 3.8. Neme Agent Considerations 3.8. Receiving Registration Replies 3.8. Longidatation and Registration Replies 4.1. Encapsulation Types 4.2. Home Agent Considerations 4.2. Foreign Agent Considerations 4.2. Home Agent Considerations 4.2. Home Agent Considerations 4.2. Home Agent Considerations 4.3. Home Agent Considerations 4.4. Multicast Datagram Routing 4.5. Mobile Routers 5. Mobile Routers 5. Mobile Routers 5. Message Authentication Codes 5. Areas of Security Concern in this Protocol 5.3. Key Management 5.4. Picking Good Raudom Numbers 5.5. Privacy 5.6. Replay Protection using Timestamps 5.6. Replay Protection using Timestamps 5.6. Replay Protection using Nonces 5.1. Replay Protection using Nonces 5.2. Replay Protection using Nonces 5.3. Replay Protection using Nonces 5.4. Replay Protection using Nonces 5.6. Replay Protection using Nonces 5.7. Replay Protection using Nonces 5.8. Replay Protection using Nonces 5.9. Replay Protection Requests 5.6. Replay Protection using Nonces 5.7. Replay Protection Using Nonces 5.8. Replay Protection Using Nonces 5.8. Replay Protection Requests 6.8. Acknowledgments 7. Replay Protection Requests 8. Replay Protect
3.5.4 Poreign-Home Authentication Extension 3.6. Wobile Node Considerations 3.6.1 Sending Registration Replies 3.6.2 Receiving Registration Replies 3.6.2 Receiving Registration Replies 3.7.1 Configuration and Registration Tables 3.7.2 Receiving Registration Replies 3.7.3 Receiving Registration Replies 3.8.1 Configuration and Registration Tables 3.8.2 Receiving Registration Replies 3.8.3 Sending Registration Replies 4.1 Encapsulation Types 4.2 Receiving Registration Replies 4.2.2 Foreign Agent Considerations 4.2.3 Home Agent Considerations 4.2.3 Home Agent Considerations 4.3 Broadcast Dategrams Routing 4.2.1 Mobile Node Considerations 4.3 Honor Registration Codes 5.3 Home Agent Considerations 5.4 Noticest Dategrams Routing 6.5 Mossage Authentication Codes 5.7 Message Authentication Codes 5.8 Home Registration Requests 5.9 Frivacy 5.9 Frivacy 5.0 Frivacy 6.0 Replay Protection using Timestamps 7.0 Frivacy 7.	3.5. 4. Foreign-Home Authentication Extension 3.6. Nobile Node Considerations 3.6. 1. Sending Registration Requests 3.6. 2. Receiving Registration Replies 3.7. Poreign Agent Considerations 3.7. Foreign Agent Considerations 3.7. Receiving Registration Replies 3.7. Receiving Registration Replies 3.7. Receiving Registration Replies 3.8. Home Agent Considerations and Registration Tables 3.8. Sending Registration Replies 4. Routing Considerations Registration Replies 4. Encapsulation Types 4. Encapsulation Types 4. L. Mobile Node Considerations 4. L. Mobile Node Considerations 4. L. Mobile Node Considerations 4. J. Home Agent Considerations 4. Sending Registration Replies 5. Foreign Agent Considerations 4. Multicast Datagram Routing 4. Multicast Datagram Routing 5. Security Consideration Codes 5. Meas of Security Concern in this Protocol 5. Message Authentication Codes 5. Message Authentication Codes 5. Message Authentication Codes 5. Privacy 5. Replay Protection using Timestamps 5. Privacy 5. Replay Protection using Nonces 6. Acknowledgments 5. Replay Protection using Nonces 6. Acknowledgments 7. Replay Protection using Nonces 7. Replay Protection using Nonces 8. Replay Protection Security Concern in the Nonces 8. Replay Protection Using Nonces 9.
3.6. Mobile Mode Considerations 3.6.1 Sending Registration Requests 3.6.3 Receiving Registration Requests 3.6.3 Receiving Registration Requests 3.7.1 Configuration and Registration Tables 3.7.2 Receiving Registration Requests 3.8.1 Mode Agent Considerations 3.8.2 Receiving Registration Requests 3.8.1. Configuration and Registration Tables 3.8.2 Receiving Registration Requests 3.8.3 Sending Registration Replies 4.2 Enceiving Registration Replies 4.2 Incapsulation Types 4.2.1 Mobile Mode Considerations 4.2.1 Mobile Routers 4.3. How Agent Considerations 4.3. How Agent Considerations 4.3. How Agent Considerations 4.3. How Agent Considerations 5. Security Consideration Codes 5. Message Authentication Codes 5. Message Authentication Codes 5. Areas of Security Concern in this Protocol 5. Areas of Security Concern in this Frotocol 5. Areas of Security Concern in this Frotocol 5. Privacy 5. Replay Protection to Registration Requests 5. Friyacy 5. Replay Protection using Timestamps 6. Acknowledgments 7. Replay Protection using Monces 7. Replay Protection using Monces 8. Acknowledgments 8.	3.6. Mobile Node Considerations 3.6. Sending Pegistration Requests 3.6. S. Receiving Registration Replies 3.6. A. Receiving Registration Replies 3.7. Perceiving Agent Considerations 3.7. Receiving Registration Requests 3.7. Receiving Registration Requests 3.8. Home Agent Considerations 3.8. Seciving Registration Replies 3.8. Seciving Registration Replies 3.8. Seciving Registration Replies 3.8. Seciving Registration Replies 4.8. Seciving Registration Replies 4.9. Nonical Pacagram Routing 4.1. Encapsulation Types 4.2. Foreign Agent Considerations 4.2. Foreign Agent Considerations 4.2. Hobile Node Considerations 4.3. Broadcast Datagram Routing 4.5. Mobile Routers 5. Security Considerations 5. Message Authentication Codes 5. Areas of Security Concern in this Protocol 5.3. Key Management 5.4. Ficking Good Random Numbers 5.5. Areas of Security Concern in this Protocol 5.3. Replay Protection using Timestamps 5.6. Replay Protection using Timestamps 5.7. Replay Protection using Timestamps 5.8. Replay Protection using Timestamps 5.9. Replay Protection using Timestamps 5.0. Replay
3.6.1. Sending Registration Requests 3.6.2. Receiving Registration Replies 3.7. Foreign Agent Considerations 3.7. L. Configuration and Registration rables 3.7. Receiving Registration Replies 3.8. Home Agent Considerations 3.8. Home Agent Considerations 3.8. Sending Registration Replies 3.8. Configuration and Registration Tables 3.8. Receiving Registration Replies 3.8. Sending Registration Replies 4. Norsiderations 4. Nobile Node Considerations 4. In Wobile Node Considerations 4. L. Mobile Node Considerations 4. L. Hombie Agent Considerations 4. L. Home Agent Considerations 4. L. Home Agent Considerations 4. L. Home Baggan Routing 5. Foreign Agents 6. ARP. Proxy ARP, and Gratuitous ARP 5. Security Considerations 5. Mendagement Considerations 5. Mendagement Consideration Requests 5. Rev Management 5. Foreign Security Concern in this Protocol 5. Replay Protection Using Timestamps 5. Frivacy 5. Replay Protection using Timestamps 5. Replay Protection using Timestamps 5. Replay Protection using Timestamps 5. Replay Protection using Nonces 5. Replay Protection using Nonces 6. Acknowledgments 7. Replay Protection Using Nonces 7. Replay Protection Using	3.6.1. Sending Registration Requests 3.6.2. Receiving Registration Replies 3.7. Pereign Agent Considerations 3.7. Recising Magnet Considerations 3.7.1. Receiving Registration Replies 3.7.3. Receiving Registration Replies 3.8.4. Mome Agent Considerations 4.1. Rochiguration and Registration Tables 3.8.1. Configuration and Registration Tables 3.8.1. Receiving Registration Replies 4.1. Rochigurations 4.2. Mone Agent Considerations 4.2. Unicast Datagram Routing 4.2. Unicast Datagram Routing 4.3. Home Agent Considerations 4.3. Home Agent Considerations 4.4. Multicast Datagram Routing 4.3. Home Agent Considerations 5.2. Areas of Security Concern in this Protocol 5.3. Areas of Security Concern in this Protocol 5.4. Are Management 5.5. Areas of Security Concern in this Protocol 5.5. Replay Protection using Timestamps 5.6. Replay Protection using Timestamps 6. Acknowledgments 5.6. Replay Protection using Timestamps 6. Acknowledgments 7. Replay Protection using Timestamps 6. Acknowledgments 7. Replay Protection using Timestamps 8.6. Acknowledgments 8.6. Replay Protection using Timestamps 9.6. Replay Protection using Timestamps 9.7. Replay Protection Timestamps 9.8. Acknowledgments 9.9. Acknowledgments
3.7. Foreign Registration Requests 3.6.3. Relibration on Retransission 3.7. Foreign Agent Considerations 3.7. Configuration and Registration Tables 3.7.1. Configuration and Registration Tables 3.8. Home Agent Considerations 3.8. Long Receiving Registration Replies 3.8. Long Receiving Registration Replies 3.8. Sending Registration Replies 4. Configuration and Registration Tables 3.8. Sending Registration Replies 4. Dinical Datagram Routing 4. Unical Datagram Routing 4. Unical Datagram Routing 4. J. Mobile Node Considerations 4. Sending Agent Considerations 4. Multicast Datagram Routing 4. Multicast Datagram Routing 5. Security Considerations 5. Mark Management 5. May Resear Authentication Codes 5. Areas of Security Concern in this Protocol 5. Areas of Security Concern in this Protocol 5. Replay Protection using Timestamps 6. Acknowledgments 5. C. Replay Protection using Timestamps 6. Acknowledgments 7. Replay Protection using Timestamps 6. Acknowledgments 7. Replay Protection using Timestamps 7. Replay Protection using Timestamps 8. C. Replay Protection using Timestamps 9. C. Replay Routertion Registration Requests 9. C. Replay Protection using Timestamps 1. Replay Protection Using Timestamps	3.6.2 Receiving Registration Replies 3.6.3 Registration Retranshission 3.7 Foreign Agent Considerations Requests 3.7.1 Configuration and Registration Tables 3.7.2 Receiving Registration Requests 3.7.3 Receiving Registration Replies 3.8.1 Sending Registration Replies 3.8.2 Sending Registration Replies 4.2 Receiving Registration Replies 4.2 B. Configuration and Registration Tables 3.8.3 Sending Registration Replies 4.1 Encapsulation Types 4.2 Home Agent Considerations 4.2.3 Home Agent Considerations 4.2.4 Hobile Node Considerations 4.2.5 Foreign Agent Considerations 4.2.5 Foreign Agent Considerations 4.2.6 ARP, Proxy ARP, and Gratuitous ARP 5.8 Security Consideration Codes 5.1 Mone Agent Consideration Codes 5.2 Areas of Security Concern in this Protocol 5.3 Resage Authentication Codes 5.4 Picking Good Random Numbers 5.5 Foreign Agent Consideration Requests 5.6 Are Replay Protection for Registration Requests 5.6 Are Replay Protection using Timestamps 5.6 Arknowledgments 5.7 Replay Protection using Timestamps 5.6 Arknowledgments 6.7 Replay Protection using Timestamps 5.6 Arknowledgments
3.6.7. Registration Retransmission 3.7. Recidying Registration Replies 3.7.1. Receiving Registration Replies 3.7.2. Receiving Registration Replies 3.7.3. Receiving Registration Replies 3.8.1. Gonfiguration and Registration Tables 3.8.1. Configuration and Registration Tables 3.8.1. Configuration Requests 3.8.2. Receiving Registration Replies 4.1. Configuration Replies 4.2. Unicast Datagram Routing 4.2. Unicast Datagram Routing 4.2. Unicast Datagram Routing 4.2. Mobile Nouters 5.3. Home Agent Considerations 4.3. Broadcast Datagrams 6.3. Mobile Routers 7. Security Considerations 7. Mobile Routers 8. Security Considerations 8. Security Considerations 9. Replay Protection using Timestamps 9. Frivacy 9. Frivacy 9. Security Condent of the Registration Requests 9. Security Condent of Security Concern in this Protection 9. Security Considerations 9. Security Considerations 9. Security Considerations 9. Security Condent of Considerations 9. Replay Protection using Timestamps 9. Security Concern in this Protection Using Monces 9. Security Concern in	3.6.3. Reciving Registration Replies 3.7. Foreign Agent Considerations 3.7. Receiving Registration Tables 3.7. Receiving Registration Requists 3.7. Receiving Registration Requists 3.8. Ame Agent Considerations 3.8. Sending Pedistration Requists 3.8. Sending Pedistration Replies 4.2. Incast Datagram Routing 4.2. Mobile Node Considerations 4.2. Foreign Agent Considerations 4.2. Home Agent Considerations 4.2. Home Agent Considerations 4.2. Foreign Agent Considerations 4.3. Home Agent Considerations 4.3. Home Agent Considerations 4.4. Multicast Datagrams 4.5. Home Agent Considerations 5.5. Home Agent Considerations 5.6. Replay Protection Codes 5.7. Key Management 5.8. Key Management 5.9. Key Management 5.9. Frivacy of Security Concern in this Protect 5.1. Key Ranagement 5.2. Replay Protection for Registration Requests 5.3. Frivacy 5.4. Replay Protection using Timestamps 5.5. Privacy 5.6. Replay Protection using Nonces 5.7. Replay Protection using Nonces 5.8. Replay Protection using Nonces 5.9. Replay Protection Registration
3.7. Foreign Agent Considerations 3.7. Foreign Agent Considerations 3.7. Configuration and Registration Tables 3.7.1. Receiving Registration Requests 3.8. Home Agent Considerations 3.8. Lonfiguration and Registration Tables 4. Receiving Registration Requests 4. Breapsulation Types 4. L. Mobile Node Considerations 4. L. Mobile Node Considerations 4. Multicast Datagram Routing 4. L. Mobile Routes 5. Routing Considerations 6. M. Multicast Datagram Routing 6. Security Considerations 7. Resage Authentication Codes 5. Meb. Proxy ARP, and Gratuitous ARP 5. Security Consideration 5. Replay Protection for Registration Requests 5. Replay Protection for Registration Requests 5. Privacy 5. Fixing Good Random Numbers 5. Privacy 5. Replay Protection using Timestamps 5. Replay Protection using Nonces 5. Acknowledgments 5. Replay Protection using Nonces 6. Acknowledgments 7. Replay Protection using Nonces 8. Replay Research Replay Protection using Nonces 9. Replay Research Replay Rese	3.7 Foreign Agent Considerations 3.7 Foreign Agent Considerations 3.7.1 Configuration and Registration Tables 3.7.2 Receiving Registration Replies 3.7.3 Receiving Registration Replies 3.8.1 Configuration and Registration Tables 3.8.1 Configuration and Registration Tables 3.8.2 Receiving Registration Replies 4.8.3 Sending Registration Replies 4.1 Encapsulation Types 4.2.1 Home Agent Considerations 4.2.3 Home Agent Considerations 4.2.3 Home Agent Considerations 4.2.4 Multicast Datagram Routing 4.2.4 Multicast Datagram Routing 4.3 Broadcast Datagram Routing 4.4 Multicast Datagram Routing 5.5 Research Datagram Routing 6.5 Replay Routing Concern in this Protocol 5.1 Message Authentication Codes 5.2 Message Authentication Codes 5.3 Key Management 5.4 Management 5.5 Pirviang Good Random Numbers 5.5 Pirviang Good Random Numbers 5.6 I Replay Protection using Timestamps 5.6 I Replay Protection using Nonces 5.7 Replay Protection using Nonces 5.6 I Replay Protection using Nonces 5.7 Replay Protection using Nonces 5.8 Replay Protection using Nonces 5.9 Pirviang Replay Protection using Nonces 5.9 Pirviang Replay Protection using Nonces 5.6 Replay Protection Replay Protection using Nonces 5.6 Replay Protection Replay Protection using Nonces 5.7 Replay Protection Replay Protection using Nonces 5.8 Replay Protection Replay Protection Using Nonces 5.9 Replay Protection Replay Protection Using Nonces 5.9 Replay Protection Replay Protection Using Nonces 6.9 Replay Protection Replay Protection Using Nonces 7 Replay Protection Replay Protection Replay Protection Using Replay Protection Re
3.7. Foreign Agent Considerations and Registration Tables 3.7. Receiving Registration Requests 3.7. Receiving Registration Replies 3.8. Home Agent Considerations 3.8. L. Configuration and Registration Tables 3.8. Receiving Registration Replies 3.8. Sending Registration Replies 4.1. Biochsulation Types 4.2. Unicast Datagram Routing 4.2. Hobile Note Considerations 4.2. Hobile Notes Considerations 4.2. Hobile Notes 5. Hobile Routers 6. Map Proxy ARP, and Gratuitous ARP 5. Security Considerations 5.1. Message Authentication Codes 5.2. Areas of Security Concern in this Protocol 5.3. Key Management 5.4. Message Authentication for Registration Requests 5.5. Privacy 5.6. Replay Protection using Timestamps 5.6. Replay Protection using Timestamps 5.6. Replay Protection using Timestamps 5.7. Replay Protection using Monces 5.6. Replay Protection using Monces 5. Replay Protection using Monces 5. Replay Replay Protection Using Monces 6. Acknowledgments	1. Foreign Agent Considerations 3.7. Receiving Registration Tables 3.7. Receiving Registration Replies 3.7. Receiving Registration Replies 3.8. Home Agent Considerations 3.8.1. Configuration and Registration Tables 3.8.2. Sending Registration Replies 3.8.3. Sending Registration Replies 4.1. Routing Considerations 4.2. Hombile Node Considerations 4.2. Hombile Node Considerations 4.2. Hombile Node Considerations 4.3. Home Agent Considerations 4.4. Multicast Datagram Routing 4.4. Multicast Datagrams 5. Home Agent Considerations 4.5. Hombile Routers 4.6. Mobile Routers 5.1. Message Authentication Codes 5.2. Areas of Security Concern in this Protocol 5.3. Key Management 5.4. Forking Good Random Numbers 5.5. Privacy 5.6. Replay Protection for Registration Requests 5.6. Replay Protection using Timestamps 5.6. Replay Protection using Monces 6. Acknowledgments 8. Standards Track 8. Rethowledgments 8. R
3.7.1. Configuration and Registration Tables 3.7.3. Receiving Registration Requests 3.8.1. Configurations 3.8.1. Configuration and Registration Tables 3.8.2. Receiving Registration Replies 3.8.3. Sending Registration Replies 4.2. Receiving Registration Replies 4.2. Encapsulation Types 4.2. Unicast Datagram Routing 4.2. Mobile Node Considerations 4.2. Mobile Node Considerations 4.3. Broadcast Datagrams Routing 4.2. Multicast Datagrams Routing 4.3. Broadcast Datagrams Routing 4.4. Multicast Datagrams Routing 5.2. Receiving Considerations 5.1. Message Authentication Codes 5.2. Areas of Security Concern in this Protocol 5.3. Areas of Security Concern in this Protocol 5.4. Privacy 5.6. Replay Protection for Registration Requests 5.6. Replay Protection for Registration Requests 5.6. Replay Protection using Timestamps 5.6. Replay Protection using Timestamps 5.6. Replay Protection using Nonces 6. Acknowledgments 8. Setulation Registration Requests 8. Setulation Registration Registrati	3.7.1. Configuration and Registration Tables 3.7.2. Receiving Registration Requests 3.7.3. Receiving Registration Replies 3.8. Home Agent Considerations 3.8.1. Configuration and Registration Tables 3.8.2. Sending Registration Regulests 3.8.3. Sending Registration Replies 4.1. Routing Considerations 4.2.1. Mobile Registrations 4.2.2. Foreign Agent Considerations 4.3.4.2.3. Home Agent Considerations 4.4.5. Mobile Routers 4.5. Mobile Routers 5.5. Replay Routing 5.5. Areas of Security Concern in this Protocol 5.4. Picking Good Random Numbers 5.5. Areas of Security Concern in this Protocol 5.4. Picking Good Random Numbers 5.5. Replay Protection for Registration Requests 5.6. Replay Protection using Timestamps 5.6. Replay Protection using Nonces 5.6. Replay Protection using Timestamps 5.6. Replay Protection using Registration Requests 5.6. Replay Protection using Nonces 5.6. Replay Protection using Registration Registrations 6. Acknowledgments 8. Replay Registration Registration Registration Registrations 8. Replay Protection using Nonces 8. Replay Protection using Registrations 8. Replay Protection Registrations 8. Replay Protection using Registrations 8. Replay Protection Registrations 9. Replay Protection Registrations 9. Replay Protection using Registrations 9. Replay Protection Registrations 9. Registrations 9. Replay R
3.7.2 Receiving Registration Requests 3.8. Home Agent Considerations 3.8.1 Configuration and Registration Tables 3.8.2 Receiving Registration Replies 4.1 Encapsulations 4.2 Unicast Datagram Routing 4.2.1 Mobile Node Considerations 4.3 Home Agent Considerations 4.3 Home Agent Considerations 4.4.2 Unicast Datagram Routing 4.2.1 Mobile Node Considerations 4.3 Home Agent Considerations 4.4.3 Home Agent Considerations 4.5 Hobbile Routers 4.6 Mobile Routers 4.6 Mobile Routers 5.6 Mobile Routers 6.6 Mobile Routers 7.1 Message Authentication Codes 5.2 Message Authentication Codes 5.3 Key Management 5.4 Picking Good Random Numbers 5.5 Furbacy 7.6 Replay Protection for Registration Requests 5.6 Privacy 7.6 Replay Protection using Timestamps 5.6 I Replay Protection using Nonces 5.6 I Replay Protection using Nonces 7.6 Acknowledgments 8 Standards Track (Page	3.7.2. Receiving Registration Requests 3.8. Home Agent Considerations 3.8. Home Agent Considerations 3.8.1. Configuration and Registration Tables 3.8.3. Sending Registration Replies 4.1. Encapsulation Types 4.2.1. Mobile Node Considerations 4.2.2. Foreign Agent Considerations 4.2.3. Home Agent Considerations 4.3.2. Foreign Routing 4.3.4. Whilicast Datagram Routing 4.3. Broadcast Datagram Routing 4.3. Broadcast Datagram Routing 4.5. Mobile Routers 5. Geneign Routing 5. Security Considerations 5. Areas of Security Concern in this Protocol 5.3. Key Management 5.4. Picking Good Random Numbers 5.5. Privacy 5.6. Replay Protection using Nonces 6.6. Acknowledgments 6. Acknowledgments 7. Replay Protection using Nonces 6. Acknowledgments 7. Replay Protection using Nonces 7. Replay Protection using Nonces 8.6. Replay Protection using Nonces 9.6. Replay Protection using Timestamps 9.6. Replay Protection using Nonces 9.6. Replay Protection using Nonces 9.6. Replay Protection using Nonces 9.6. Replay Protection using Timestamps 9.6. Replay Protection using Nonces 9.6. Replay Rotection Registration Reg
3. 8. 7.3. Receiving Registration Replies 3. 8. 1. Configuration and Registration Tables 3. 8. 2. Receiving Registration Requests 3. 8. 3. Sending Registration Requests 4. 2. Receiving Registration Replies 4. 2. Hobitation Types 4. 2. Foreign Agent Considerations 4. 3. Broadcast Datagram Routing 4. 3. Broadcast Datagram Routing 4. 5. Mobile Routers 5. Routers 5. Message Authentication Codes 5. Areas of Security Concern in this Protocol 5. Areas of Security Concern in this Fortocol 6. Ar	3.8. Home Agent Consideration Replies 3.8. Home Agent Considerations 3.8.1. Configuration and Registration Tables 3.8.2. Receiving Registration Requests 3.8.3. Sending Registration Replies 4.1. Encapsulation Types 4.2. Unicast Datagram Routing 4.2. Foreign Agent Considerations 4.3. Home Agent Considerations 4.3. Home Agent Considerations 4.4. Multicast Datagrams 4.5. Mobile Routes 5. Security Consideration Consideration Consideration Consideration Codes 5.1. Message Authentication Codes 5.2. Areas of Security Concern in this Protocol 5.3. Rey Management 5.4. Picking Good Random Numbers 5.5. Privacy 5.6. Replay Protection using Nonces 5.6. Replay Protection using Replay Protection using Nonces 5.6. Replay Replay Protection Using Nonces 6. Acknowledgments 6. Acknowledgments 7. Replay Protection Using Nonces 8. Replay Replay Protection Using Nonces 8. Replay Replay Protection Using Nonces 8. Replay Replay Replay Protection Using Nonces 8. Replay R
3.8. Home Agent Considerations 3.8. Lonfiguration and Registration Tables 3.8. Sending Registration Requests 3.8. Sending Registration Requests 4.1. Encapsulation Types 4.2. Unicast Datagram Routing 4.2. Mobile Node Considerations 4.2. Home Agent Considerations 4.2. Home Agent Considerations 4.3. Home Agent Considerations 4.3. Home Agent Considerations 4.4. Multicast Datagram Routing 4.5. Mobile Routers 4.6. MAP. Proxy ARP, and Gratuitous ARP 5. Security Consideration Codes 5.1. Message Authentication Codes 5.2. Areas of Security Concern in this Protocol 5.3. Key Management 5.4. Management 5.4. Management 5.5. Privacy 6. Replay Protection using Timestamps 5.6. Replay Protection using Timestamps 5.6. Replay Protection using Nonces 5.6. Replay Protection using Nonces 6. Acknowledgments 8.6. Replay Protection using Nonces 8.6. Replay Protection using Management 8.6. Acknowledgments 8.6. Replay Protection using Management 8.6. Acknowledgments 8.7. Replay Protection using Management 8.6. Acknowledgments 8.6. Replay Protection using Management 8.7. Replay Protection using Management 8.8. Replay Protection using Management 8.9. Replay Re	3.8. Home Agent Considerations 3.8.1. Configuration and Registration Tables 3.8.1. Configuration and Registration Requests 3.8.3. Sending Registration Replies 4.1. Encapsulation Types 4.2. Unicast Datagram Routing 4.2.1. Mobile Node Considerations 4.2.2. Percign Agent Considerations 4.3. Home Agent Considerations 4.4. Multicast Datagram Routing 4.5. Mobile Routers 5. Hobile Routers 6. Mobile Routers 7. Areas of Security Concern in this Protocol 5.3. Areas of Security Concern in this Protocol 5.3. Areas of Security Concern in this Protocol 5.3. Rey Management 5.4. Picking Good Random Numbers 5.5. Privacy 6.6. Picking Good Random Security Concern in this Protocol 6.1. Replay Protection using Timestamps 7.6. 2. Replay Protection using Nonces 8.6. 2. Replay Protection using Nonces 9.6. Acknowledgments 8.6. Acknowledgments 9.6. Acknowledgments 9.7. Replay Protection using Nonces 9.8. Acknowledgments 9.8. Acknowledgments 9.9.
3.8.1. Configuration and Registration Tables 3.8.2. Receiving Registration Requests 3.8.3. Sending Registration Replies 4.1. Encapsulation Types 4.2. Unicast Datagram Routing 4.2. Unicast Datagram Routing 4.2.1. Mobile Node Considerations 4.3.4. Wollicast Datagram Routing 4.3.4. Multicast Datagram Routing 4.5. Mobile Routers 6.5. RPP, Proxy ARP, and Gratuitous ARP 5. Security Considerations 5. L. Message Authentication Codes 5. L. Message Authentication Codes 5. Areas of Security Concern in this Protocol 5.3. Areas of Security Concern in this Protocol 5.3. Areas of Security Concern in this Protocol 5.5. Privacy 5.6. Replay Protection for Registration Requests 5.6. Replay Protection using Nonces 5.6. Replay Protection using Nonces 6. Acknowledgments 7. Replay Protection using Nonces 7. Areas of Security Concern in this Protocol 6. Acknowledgments 7. Replay Protection using Nonces 7. Replay Protection using Nonces 8. Acknowledgments 8. Acknowledgments 8. Acknowledgments 9. Acknowledgments	3.8.1. Configuration and Registration Tables 3.8.2. Receiving Registration Requests 3.8.3. Sending Registration Requests 4.1. Encapsulation Types 4.2. Unicast Datagram Routing 4.2.1. Woblle Node Considerations 4.2.3. Home Agent Considerations 4.3.4.3. Home Agent Considerations 4.4. Multicast Datagram Routing 4.5. Mobile Routers 4.6. ARP, Proxy ARP, and Gratuitous ARP 5. Security Consideration Codes 5.1. Message Authentication Codes 5.2. Areas of Security Concern in this Protocol 5.3. Rey Management 5.4. Picking Good Random Numbers 5.5. Privacy 5.6. Replay Protection using Nonces 5.6. Replay Protection using Nonces 6. Acknowledgments 7. Acknowledgments 8.5. Replay Protection using Nonces 8.6. Acknowledgments 8.6. Acknowledgments 8.7. Replay Protection using Nonces 8.7. Replay Protection using Nonces 8.8. Replay Protection using Nonces 8.9. Replay Replay Protection Using Nonces 8.9. Replay Re
7.8. Conting Registration Requests 3.8.2. Sending Registration Requests 3.8.3. Sending Registration Replies 4.1. Encapsulation Types 4.2. Unicast Datagram Routing 4.2.1. Mobile Node Considerations 4.2.3. Home Agent Considerations 4.3.3. Home Agent Considerations 4.4. Multicast Datagrams Routing 4.5. Mobile Routers 5. Security Considerations 5. Security Considerations 5. Lossage Authentication Codes 5.1. Message Authentication Codes 5.2. Rey Management 5.3. Key Management 5.4. Picking Good Random Numbers 5.5. Privacy 5.6. Replay Protection using Timestamps 5.6. Replay Protection using Nonces 6. Acknowledgments 7. Replay Protection using Nonces 8.6. Replay Protection using Nonces 8.6. Acknowledgments 8.6. Replay Protection using Nonces 8.6. Replay Protection using Registration Requests 8.6. Replay Protection using Nonces 8.6. Replay Protection using Nonces 8.6. Replay Protection using Registration Requests 8.6. Replay Protection Using Nonces 8.6. Replay Replay Protection Using Nonces 8.6. Replay Protection Registration Requests 8.6. Replay Protection Using Nonces 8.6. Replay Protection Using Nonces 8.6. Replay Registration Requests 8.6. Replay Protection Using Nonces 8.6. Replay Protection Using Nonces 8.6. Replay Registration Registr	7.8. Control Registration Requests 3.8.2. Receiving Registration Requests 4.1. Encapsulation Types 4.2. Unicast Datagram Routing 4.2. Unicast Datagram Routing 4.2. Thorigin Agent Considerations 4.3. Home Agent Considerations 4.3. Home Agent Considerations 4.4. Multicast Datagram 4.5. Mobile Routers 4.6. Map Proxy ARP, and Gratuitous ARP 5. Security Considerations 5.1. Message Authentication Codes 5.1. Message Authentication Codes 5.2. Areas of Security Concern in this Protocol 5.3. Key Management 5.4. Picking Good Random Numbers 5.5. Privacy 5.6. Replay Protection using Nonces 6.6. Acknowledgments 7.6. Replay Protection using Nonces 8.6.1. Replay Protection using Nonces 8.6.2. Replay Protection using Nonces 9.6.4. Acknowledgments 9.6.5. Replay Protection using Nonces 9.6.6. Acknowledgments 9.6.6. Acknowledgments 9.7. Account No. Accou
4. Routing Registration Replies 4. Routing Consideration Replies 4. 1. Encapsulation Types 4. 2. Unicast Datagram Routing 4. 2. 4. 2. Foreign Agent Considerations 4. 2. 3. Howhle Node Considerations 4. 3. 2. Foreign Agent Considerations 4. 3. Broadcast Datagram Routing 4. 5. Multicast Datagram Routing 4. 5. Multicast Datagram Routing 5. 4. 4. Multicast Datagram Routing 5. 4. Multicast Datagram Routing 5. 5. Routing Considerations 5. 1. Message Authentication Codes 5. 1. Message Authentication Codes 5. 1. Message Authentication Codes 5. 1. Replay Protection in this Protocol 5. 3. Areas of Security Concern in this Protocol 5. 5. Privacy 5. 5. Privacy 6. 6. Replay Protection using Nonces 7. 6. 6. 1. Replay Protection using Nonces 8. 6. 1. Replay Protection using Nonces 9. 6. Acknowledgments 8. Acknowledgments 9. Acknowled	4. Routing Registration Replies 4. Routing Consideration 4.1 Encapsulation Types 4.2 Unicast Datagram Routing 4.2. Unicast Datagram Routing 4.3. 4.2.3. Hobbile Node Considerations 4.3. 4.3. Broadcast Datagram Routing 4.3. Broadcast Datagram Routing 4.5. Mobile Routers 4.6. ARP, Proxy ARP, and Gratuitous ARP 5. Security Considerations 5. I. Message Authentication Codes 5. I. Message Authentication Codes 5. Areas of Security Concern in this Protocol 5. Areas of Security Consideration Security Concern in this Protocol 5. Areas of Security Concern in this Protocol 6. Area
4. Routing Consideration Replies  4. Encapsulation Types  4. Unicast Datagram Routing  4. 2. Unicast Datagram Routing  4. 2. Foreign Agent Considerations  4. 3. Home Agent Considerations  4. 3. Home Agent Considerations  4. 3. Hombile Routers  5. Security Considerations  5. Measage Authentication Codes  5. Areas of Security Concern in this Protocol  5. Areas of Security Concern in this Protocol  5. Frivacy  5. Frivacy  6. Acknowledgments  6. Acknowledgments  7. Security Concern in this Protocol  8. Feplay Protection for Registration Requests  9. Frivacy  9. Frivacy  10. Replay Protection using Nonces  10. Acknowledgments  11. Replay Protection using Nonces  12. Replay Protection using Nonces  13. Rey Management  14. Replay Protection using Nonces  15. Security Concern in this Protocol  16. Replay Protection using Nonces  17. Resplay Protection using Nonces  18. Rey Management  19. Replay Protection using Nonces  19. Replay Protection using Nonces  19. Rexkins  19. Replay Protection Using Nonces  19. Rexkins	4. Routing Consideration Replies  4. Encapsulation Types  4. Unicast Datagram Routing  4. 2. Unicast Datagram Routing  4. 2. Foreign Agent Considerations  4. 3. Home Agent Considerations  4. 3. Home Agent Considerations  4. 3. Home Agent Considerations  4. 3. Broadcast Datagram Routing  4. 3. Mobile Routers  5. Security Considerations  5. Lowersage Authentication Codes  6. Lowersage Authentication Codes  6. Lowersage Authentication
4. Noturing Considerations 4.1. Encapsulation Types 4.2. Unicast Datagram Routing 4.2.1. Mobile Node Considerations 4.2.2. Foreign Agent Considerations 4.3. Home Agent Considerations 4.3. Home Agent Considerations 4.4. Multicast Datagram Routing 4.5. Mobile Routers 5. Hobile Routers 6. Meb. Proxy ARP, and Gratuitous ARP 7. Mobile Routers 7. Message Authentication Codes 7. Areas of Security Concern in this Protocol 7.3. Key Management 7.4. Picking Good Random Numbers 7.5. Areas of Security Concern in this Protocol 7.3. Key Management 7.5. Replay Protection using Timestamps 7.6. Replay Protection using Nonces 7.6. Replay Protection using Nonces 7.6. Replay Protection using Nonces 7.6. Acknowledgments 7.6. Replay Protection using Nonces 7.6. Acknowledgments 8.6.1. Replay Protection using Nonces 8.6.2. Replay Protection using Nonces 8.6.3. Replay Protection using Nonces 8.6.1. Replay Protection Using Nonces 8.6.2. Replay Protection Using Nonces 8.6.2. Replay Protection Using Nonces 9.6.6. Acknowledgments 9.6.7. Replay Protection Using Nonces 9.6.8. Replay Protection Using Nonces 9.6.8. Replay Protection Using Nonces 9.6.9. Replay Protection Using Nonces 9.6.9. Replay Protection Using Nonces 9.6.9. Replay Protection Using Nonces 9.6. Repla	4. Noturing Considerations 4.1. Encapsulation Types 4.2. Unicast Datagram Routing 4.2. Unicast Datagram Routing 4.2. Unicast Datagram Souting 4.3. Howelle Node Considerations 4.3. Home Agent Considerations 4.4. Multicast Datagram Routing 4.5. Mobile Routers 4.6. ARP, Proxy ARP, and Gratuitous ARP 5. Security Considerations 5.1. Message Authentication Codes 5.1. Message Authentication Codes 5.1. Areas of Security Concern in this Protocol 5.3. Areas of Security Concern in this Protocol 5.3. Areas of Security Concern in this Protocol 5.5. Privacy 5.6. Replay Protection of Registration Requests 5.6. Replay Protection using Nonces 6. Acknowledgments 6. Acknowledgments 7. Replay Protection using Nonces 7. Acknowledgments 8. Acknowledgments 9. Acknowl
4.1. Encapsulation Types 4.2. Unicat Datagram Routing 4.2.1. Home Agent Considerations 4.2.2. Foreign Agent Considerations 4.3.1. Home Agent Considerations 4.3. Mondle Notes 4.4. Multicast Datagrams 4.4. Multicast Datagrams 5.6. Mobile Routers 7. Mobile Routers 8.5. Mobile Routers 8.6. Mobile Routers 8.6. Mobile Routers 8.7. Message Authentication Codes 8.7. Message Authentication Codes 8.7. A Forking Good Random Numbers 8.8. Management 8.9. Privacy 8.6. Picking Good Random Numbers 8.6. Peplay Protection for Registration Requests 8.6. Replay Protection using Timestamps 8.6. Replay Protection using Nonces 9.6. Replay Protection using Nonces 9.6. Acknowledgments 9.6. Acknowledgments 9.7. Randards Track (Paage	4.1. Encapsulation Types 4.2. Unicat Datagram Routing 4.2.1. Home Agent Considerations 4.2.3. Home Agent Considerations 4.3. Home Agent Considerations 4.3. Mobile Routers 5. Security Considerations 6. Areas of Security Concern in this Protocol 5.3. Key Management 5.4. Picking Good Random Numbers 5.5. Privacy 5.6. Replay Protection using Timestamps 5.6. Replay Protection using Nonces 6. Acknowledgments 7. Replay Protection using Nonces 8.6. Replay Protection using Nonces 9.6. Acknowledgments 1. Replay Protection using Nonces 1. Replay Nonces 1.
4.2. Unicast Datagram Routing 4.2. In Mobile Node Considerations 4.2.1. Mobile Node Considerations 4.3. Home Agent Considerations 4.3. Home Agent Considerations 4.4. Multicast Datagrams 4.6. Mobile Routers 4.6. Mobile Routers 5. Security Considerations 5.1. Message Authentication Codes 5.1. Message Authentication Codes 5.1. Message Authentication Codes 5.2. Areas of Security Concern in this Protocol 5.3. Rey Management 5.4. Picking Good Raudom Numbers 5.5. Privacy 5.6. Replay Protection for Registration Requests 5.6. Replay Protection using Nonces 6. Acknowledgments S.6.2. Replay Protection using Nonces 7.6. Replay Protection using Nonces 8.6.1. Replay Protection using Nonces 9.6.2. Replay Protection using Nonces 9.6.3. Replay Protection using Nonces 9.6.4. Replay Protection using Nonces 9.6.5. Replay Protection using Nonces 9.6.6. Acknowledgments 9.6.7. Replay Protection using Nonces 9.6.6. Acknowledgments 9.6.7. Replay Protection Using Nonces 9.6.7. Replay Protectio	4.2. Unicast Datagram Routing 4.2. Unicast Datagram Routing 4.2.1. Mobile Node Considerations 4.2.3. Home Agent Considerations 4.3. Broadcast Datagrams 4.4. Multicast Datagram Routing 4.5. Mobile Routers 4.5. Mobile Routers 5.1. Message Authentication Codes 5.1. Message Authentication Codes 5.1. Message Authentication Codes 5.1. Rey Management 5.2. Replay Protection for Registration Requests 5.5. Privacy 5.6. Picking Good Random Numbers 5.6. Picking Good Random Standards Timestamps 5.6. Replay Protection using Nonces 6.6. Acknowledgments 8.6. Acknow
4.2.1. Mobile Node Considerations 4.2.2. Foreign Agent Considerations 4.3.3. 40.2.3. Home Agent Considerations 4.3. Broadcast Datagrams 4. Multicast Datagrams 6. Mobile Routers 7. Security Considerations 7. Security Considerations 7. Areas of Security Concern in this Protocol 7. Areas of Security Area (Area) 7. Areas (Area) 7. Areas of Security Area (Area) 7. Areas (Area) 7. Area (Area) 7. A	4.2.1 Mobile Node Considerations 4.2.2. Foreign Agent Considerations 4.3.4 Multicast Datagrams 4.4 Multicast Datagram Routing 4.5. Mobile Routers 4.6. ARP, Proxy ARP, and Gratuitous ARP 5. Security Considerations 5. L. Message Authentication Codes 5. L. Message Authentication Codes 5. A reas of Security Concern in this Protocol 5.3. Rey Management 5.4. Picking Good Random Numbers 5.5. Privacy 5.6. Peplay Protection for Registration Requests 5.6. Replay Protection using Nonces 5.6. Replay Protection using Nonces 6. Acknowledgments 8.6. Acknowledgments 8.7. Rendards Track (Page
4.3. Frozign Agent Considerations 4.3. Home Agent Considerations 4.3. Home Agent Considerations 4.4. Multicast Datagrams Routing 4.5. Mobile Routers 5. Security Considerations 5. Security Considerations 5.1. Message Authentication Codes 5.2. Areas of Security Concern in this Protocol 5.3. Rey Management 5.4. Picking Good Random Numbers 5.5. Privang Good Random Numbers 5.6. Peplay Protection for Registration Requests 5.6. Replay Protection using Timestamps 5.6.2. Replay Protection using Nonces 6. Acknowledgments 7. Standards Track 8. Standards Track 9. Services 9.	4.3. Frozign Agent Considerations 4.3. Home Agent Considerations 4.3. Home Agent Considerations 4.4. Multicast Datagrams 4.5. Mobile Routers 4.6. MP. Proxy ARP, and Gratuitous ARP 5. Security Considerations 5.1. Message Authentication Codes 5.2. Areas of Security Concern in this Protocol 5.3. Key Management 5.4. Picking Good Raudom Numbers 5.5. Privacy 6.6. Picking Good Raudom Numbers 7.6. Replay Protection using Timestamps 7.6. Replay Protection using Nonces 8.6. Acknowledgments 8.6. Acknowledgments 8.6. Acknowledgments 8.6. Acknowledgments 8.6. Acknowledgments 9.6. Acknowledgments 8.6. Acknowledgments 9.6. Ac
4.3. Foreign Agent Considerations 4.3. Broadcast Datagrams 4.4 Multicast Datagram Routing 4.5. Mobile Routers 4.6. ARP, Proxy ARP, and Gratuitous ARP 5. Security Considerations 5.1. Message Authentication Codes 5.2. Areas of Security Concern in this Protocol 5.3. Key Management 5.4. Picking Good Random Numbers 5.5. Privacy 5.6. Replay Protection using Timestamps 5.6. Replay Protection using Timestamps 5.6. Replay Protection using Nonces 6. Acknowledgments 7. Standards Track 8. Standards Track 8. Standards Track 9. Standards Track 1. Replay Protection Using Nonces 9. Standards Track 9. Standards Track 1. Replay Protection Using Nonces 9. Standards Track 9. Standards Track 1. Standards Trac	4.2. Foreting Agent Considerations 4.3. Foreting Agent Considerations 4.3. Broadcast Datagrams 4.4. Multicast Datagram Routing 4.5. Mobile Routers 4.6. ARP, Proxy ARP, and Gratuitous ARP 5. Security Considerations 5. L. Message Authentication Codes 5. L. Areas of Security Concern in this Protocol 5. A Reas of Security Consideration Codes 5. A Reas of Security Consideration Codes 5. A Reas of Security Concern in this Protocol 5. A Reas of Security Concern in this Protocol 5. A Reas of Security Consideration Codes 5. A Reas of Security
4.3. Fronder degret Considerations 4.3. Fronders degret Considerations 4.4. Multicast Datagram Routing 4.5. Mobile Routers 4.6. ARP. Proxy ARP, and Gratuitous ARP 5. Security Considerations 5. Hessage Authentication Codes 5. 2. Areas of Security Concern in this Protocol 5. 3. Key Management 5. 4. Picking Good Random Numbers 5. 5. Privacy 5. 6. Replay Protection for Registration Requests 5. 6. 1. Replay Protection using Timestamps 6. Acknowledgments 6. Acknowledgments 7. Standards Track 8. Perkins 8. Standards Track 9. Replay Protection Using Nonces 9. Standards Track 9. Replay Protection Using Nonces 9. Replay	4.3. Fronder Agent Considerations 4.3. Fronders Agent Considerations 4.4. Multicast Datagrams 4.5. Mobile Routers 5. Security Considerations 5. Measage Authentication Codes 5.2. Areas of Security Concern in this Protocol 5.3. Key Management 5.4. Picking Good Random Numbers 5.5. Privacy 5.6. Replay Protection for Registration Requests 5.6. Replay Protection using Timestamps 5.6. 2. Replay Protection using Nonces 6. Acknowledgments 7. Standards Track 8. Standards Track 8. Standards Track 9. Standards Tra
4.4. Broadcast Datagrams 4.5. Broadcast Datagram Routing 4.5. Mobile Routers 4.6. ARP, Proxy ARP, and Gratuitous ARP 5. Security Considerations 5.1. Message Authentication Codes 5.1. Message Authentication Codes 5.1. Respective Concern in this Protocol 5.3. Key Management 5.4. Picking Good Random Numbers 5.5. Privacy 5.6. Privacy 6.6.1. Replay Protection using Timestamps 7.6.2. Replay Protection using Nonces 6.6.1. Replay Protection using Nonces 7.6. Acknowledgments 8.6.2. Replay Protection using Nonces 9.6.1. Replay Protection using Nonces 9.6.1. Replay Protection using Nonces 9.6.2. Replay Protection using Nonces 9.6.3. Replay Protection using Nonces 9.6.4. Replay Protection using Nonces 9.6.6. Acknowledgments 9.6.7. Replay Protection using Nonces 9.6.8. Replay Protection using Nonces 9.6.9. Replay Protection using Nonces 9.6. R	4.4. Broadcast Datagrams 4.4. Multicast Datagram Routing 4.5. Mobile Routers 4.6. ARP, Proxy ARP, and Gratuitous ARP 5. Security Considerations 5.1. Message Authentication Codes 5.2. Areas of Security Concern in this Protocol 5.3. Key Management 5.4. Picking Good Random Numbers 5.5. Privacy 5.6. Protocotion for Registration Requests 5.6. Replay Protection using Timestamps 5.6. 2. Replay Protection using Nonces 6. Acknowledgments 6. Acknowledgments 7. Replay Protection using Nonces 7. Replay Protection using Nonces 7. Replay Protection using Nonces 8. Replay Protection Using Nonces 9. Replay Protection Using Non
4.4 Multicast Datagram Routing 4.5 Mobile Routers 4.6 ARP, Proxy ARP, and Gratuitous ARP 5. Security Considerations 5.1 Message Authentication Codes 5.2 Areas of Security Concern in this Protocol 5.3 Key Management 5.4 Picking Good Random Numbers 5.5 Privacy 5.6 Replay Protection using Timestamps 5.6. Replay Protection using Nonces 6. Acknowledgments 6. Acknowledgments 7 Randards Track 8 Perkins 8 Standards Track 9 Replay Protection Using Nonces 9 Section 1 Regulation Requests 9 Section 1 Regulation R	4.6 Multicast Datagram Routing 4.5 Mobile Routers 4.6 ARP, Proxy ARP, and Gratuitous ARP 5. Security Considerations 5.1 Message Authentication Codes 5.2. Areas of Security Concern in this Protocol 5.3. Key Management 5.4 Picking Good Random Numbers 5.5. Privacy 5.6. Replay Protection for Registration Requests 5.6. Replay Protection using Timestamps 5.6. 2. Replay Protection using Nonces 6. Acknowledgments 7. Acknowledgments 8. Standards Track 9.
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5.6.2. Replay Protection using Nonces 6. Acknowledgments Perkins Standards Track (Page	5.6.2. Replay Protection using Nonces
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	October 1996	72 72 72 73 73 73 74 74 75 75 75 75 75 75 75 75 75 75 75 75 75	quely identifies the fore, a node must ress in order to rams destined to hange its point of te, currently one employed:	roughout much of	The first makes I higher-layer econd has obvious considering the puters.	dating node es such a nt of attachment to	er nodes after Internet, yet	(Page 3)	
rfc2002.txt	IP Mobility Support	n Agent Care-of A sted Care-of Addr	IP version 4 assumes that a node's IP address uniquely identifies the node's point of attachment to the Internet. Therefore, a node must be located on the network indicated by its IP address in order to receive datagrams destined to it; otherwise, datagrams destined to the node would be undeliverable. For a node to change its point of attachment without losing its ability to communicate, currently one of the two following mechanisms must typically be employed:  a) the node must change its IP address whenever it changes its noting of attachment.	host-specific routes must be propagated throughout much the Internet routing fabric.	s are often unacceptable.  to maintain transport and changes location. The s ms, especially relevant o of notebook (mobile) con	m is required for accommonet. This document definionedes to change their poiging their IP address.	e to communicate with oth oint of attachment to the ddress.	Standards Track	,
13 1998 10:38:26	RFC 2002	A. Patent Issues A.1. IBM Patent #5.159.592. A.2. IBM Patent #5.148.479. B. Link-Layer Considerations C. TCP Considerations C.1 TCP Timers C.2 TCP Contestion Management D. Example Scenarios D.1. Registering with a Foreign D.3. Registering with a Co-Loca D.3. Detugistering with a Co-Loca D.3. Detugistering with a Co-Loca E. Applicability of Prefix Lengths Editor's Address	IP version 4 assumes that a node's IP address uniquely identifies the node's point of attachment to the Internet. Therefore, a node must be located on the network indicated by its IP address in order to receive datagrams destined to it, otherwise, datagrams destined to the node would be undeliverable. For a node to change its point of attachment without losing its ability to communicate, currently one of the two following mechanisms must typically be employed:  a) the node must change its IP address whenever it changes its built of attachment.	b) host-specific routes must be the Internet routing fabric.	Both of these alternatives are often unacceptable. The first makes it impossible for a node to maintain transport and higher-layer connections when the node changes location. The second has obvious and severe scaling problems, especially relevant considering the explosive growth in sales of notebook (mobile) computers:	A new, scalable, mechanism is required for accommodating node mobility within the Internet. This document defines such a muchanism, which enables nodes to change their point of attachment the Internet without changing their IP address.	1.1. Protocol Requirements A mobile node must be able to communicate with other nodes after changing its link-layer point of attachment to the Internet, yet without changing its IP address.	Perkins	
May 13			134 135 139 140 142 143	145 146 147	149 150 151 152 153	155 156 157 158 158		168 170 P	

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	October 1996	er nodes that do ol enhancements are s any of the new	location of a ect against remote		ed to the Internet have a e than traditional to be battery tent. Therefore, e link by which a hould be minimized, mall as is		additional That is, a mobile zation that owns the	ally not change quently than once	routed based on I not, for example,		from one IP subnet to across homogeneous nus media. That is, Thernet segment to nut from an Ethernet Le node's IP address	obility management obility management	[Page 4]		
rfc2002.txt	IP Mobility Support	A mobile node must be able to communicate with other nodes that do not implement these mobility functions. No protocol enhancements required in hosts or routers that are not acting as any of the new architectural entities introduced in Section 1.5.	All messages used to update another node as to the location of a mobile node must be authenticated in order to protect against remote redirection attacks.		The link by which a mobile node is directly attached to the Internet may often be a Wireless link. This link may thus have a substantially lower bandwidth and higher error rate than traditional wired networks. Moreover, mobile nodes are likely to be battery powered, and minimizing power consumption is important. Therefore, the number of administrative messages sent over the link by which a mobile node is directly attached to the Internet should be minimized and the size of these messages should be kept as small as is		The protocols defined in this document place no additional constraints on the assignment of IP addresses. That is, a mobile node can be assigned an IP address by the organization that owns machine.	This protocol assumes that mobile nodes will generally not change their point of attachment to the Internet more frequently than once per second.	nt IP unicast datagrams are routed based on in the datagram header (and not, for exampl		o move bility rogenec m one E moveme	of Mobile IP as solving the "macro" mobility is less well suited for more "micro" mobility	Standards Track		
May 13 1998 10:38:26	RFC 2002	A mobile node must be ab not implement these mobi required in hosts or rou architectural entities i	All messages used to upd mobile node must be auth redirection attacks.	.2. Goals	The link by which a mobile node is directly may often be a Wireless link. This link ma substantially lower bandwidth and higher er wired networks. Moreover, mobile nodes are powered, and minimizing power consumption it he number of administrative messages sent mobile node is directly attached to the Interact the size of these messages should be kereasonably possible.	1.3. Assumptions	The protocols defined in constraints on the assign node can be assigned an machine.	This protocol assumes the their point of attachment per second.	This protocol assumes that the destination address in by source address).	4. Applicability	Mobile IP is intended to enable nodes t another. It is just as suitable for mo media as it is for mobility across hete Nobile IP fearlitetes node movement fro another as well as it accommodates node segment to a wireless LAN, as long as t remains the same after such a movement.	One can think of Mobile IF problem. It is less well	Perkins	÷	
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	October 1996	y attaching a ement (4) message.	rd a mobile node, node while it is two different types care-of address is ch the mobile node of address' is an that mobile node work interfaces.	municating. A e or stationary.	extended period of hanged regardless nternet.	network prefix address. Note that liver dategrams ss to the mobile	can communicate at network layer.	it of some rpically, the edia Access Control		[Page 6]
rfc2002.txt	IP Mobility Support	. Terminology This document frequently uses the following terms: Agent Advertisement An advertisement message constructed by attaching a Special Extension to a router advertisement [4] message.	Address The termination point of a tunnel toward a mobile node, for datagrams forwarded to the mobile node while it is away from home. The protocol can use two different types of care-of address: a "foreign agent care-of address" is an address of a foreign agent with which the mobile node is registered, and a "co-located care-of address" is an externally obtained local address which the mobile node has associated with one of its own network interfaces.	dent Node A peer with which a mobile node is communicating. A correspondent node may be either mobile or stationary tetwork Any network other than the mobile node's Home Notwork	ess An IP address that is assigned for an extended period of time to a mobile node. It remains unchanged regardless of where the node is attached to the Internet.	Note A network, possibly virtual, having a network prefix matching that of a mobile node's home address. Note the standard IP routing mechanisms will deliver datagrams destined to a mobile node's Home Address to the mobile node's Home Network.	y or medium over which nodes layer. A link underlies the	or Address used to identify an endpoint of some communication over a physical link. Typically, the Link-Layer address is an interface's Media Access Control (MAC) address.	Agent Either a home agent or a foreign agent.	Standards Track
May 13 1998 10:38:26	283 284 RFC 2002 285	286 287 1.6. Terminology 289 This document frequent 290 Agent Advertisement 291 Agent Advertisement 292 An adverti	Care-of i	Correspor Foreign b	Home Addr	317 Home Network 318 A network 319 matching 320 standard 321 destined 322 node's Ho	Link	Link-Laye	Mobility	338 Perkins
Page 5				·				-		
	October 1996	lens transceivers, area. As long as achment on obility (i.e.,	entities:  ttachment from one node may change its may continue to Tocation using its connectivity to a	ch tunnels	which provides	gistered. The ms to the mobile home agent. For agent may serve as home network	as a "permanent" IP ay from its home e mobile node and	fall IP datagrams this document for ctions (e.g., as in		[Page 5]
rfc2002.txt	IP Mobility Support	euplications for example, handoff amongst wireless transceive each of which covers only a very small geographic area. As lon mode movement does not occur between points of attachment on different does not occur between points of attachment on the ferent IP submets, link-layer mechanisms for mobility (i.e., link-layer handoff) may offer faster convergence and far less overhead rhan Hobile IP.	Mobile IP introduces the following new functional entities:  Mobile Node  A host or router that changes its point of attachment from one network or subnetwork to another. A mobile node may change its location without changing its IP address; it may continue to communicate with other Internet nodes at any location using its (constant) IP address, assuming link-layer connectivity to a	point of attachment is available.  We Agent  A router on a mobile node's home network which tunnels datagrams for delivery to the mobile node when it is away from home, and maintains current location is consistent is a way from	a mobile node's visited network	routing Services to the mobile node while registered. The foreign agent detunnels and delivers datagrams to the mobile node that were tunneled by the mobile node's home agent. For datagrams sent by a mobile node, the foreign agent may serve as a default router for registered mobile nodes.  The node is given a long-term IP address on a home network	is administered in the same way a d to a stationary host. When aw f address is associated with the mode's current point of attach	node uses its home address as the source address of all IP datagrams that it sends, except where otherwise described in this document for datagrams sent for certain mobility management functions (e.g., as in Section 3.6.1.1).		Standards Track
May 13 1998 10:38:26	RFC 2002	applications for example, each of which covers only a node movement does not occur different IP submets, link-link layer handoff) may offe overhead rhan Mobile IP.	Mobile IP introduce Mobile Node A host or row network or switcher switcher switcher with Communicate with (constant) II	point of atta Home Agent A router on a datagrams for home, and min	node. Foreign Agent A router on a	Coreign agent foreign agent node that wen datagrams ser a default rou A mobile node is gi	This home address i address is provided network, a "care-of reflects the mobile	node uses its home that it sends, exce datagrams sent for Section 3.6.1.1).		Porkins

Page 6

May 13	May 13 1998 10:38:26	38:26 rfc2002.txt	Page 7
	RFC 2002	IP Mobility Support October 1996	1996
24 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Mobility	Binding The association of a home address with a care-of address, along with the remaining lifetime of that association.	iress, n.
250 250 251 252 253 253 253	Mobility	A collection of security contexts, between a pair of nodes, which may be applied to wholie IP protocol missinges exchanged between them. Each context indicates an authentication algorithm and mode (Section 5.1), a secret (a shared key, or appropriate public/private (Section 5.6).	ates
356	Node	A host or a router.	
358 359 360	Monce	A randomly chosen value, different from previous cho inserted in a message to protect against replays.	choices,
361 361 364 365 365	Security	Security Parameter Index (SPI) An index identifying a security context between a pair of nodes among the contexts available in the Mobility Security Association. SPI values 0 through 255 are reserved and MUST NOT he used in any Mobility Security Association.	ir ty
368 369 370 372	Tunne l	The path followed by a datagram while it is encapsulated. The model is that, while it is encapsulated, a datagram is routed to a Knowledgeable decapsulating agent, which decapsulates the datagram and then correctly delivers it to its ultimate destination.	ated. ram ich s it
375 375 376 377 379 880	Virtual h	Network  A network with no physical instantiation beyond a router (with a physical network interface on another network). The router (e.g., a home agent) generally advertises reachability to the virtual network using conventional routing prococols.	iter (). al
383 383 584	Visited N	Network A network other than a mobile node's Home Network, to Which the mobile node is currently connected.	
385 386 387 388 389	Visitor L	hist The list of mobile nodes visiting a foreign agent.	
390 391 392 393 394 Perkins	ins	Standards Track (Page	, e 7]

Ma	May 13 199	1998 10:38:26	rfc2002.txt		Page 8
395 396 397	RFC 2002		IP Mobility Support	October 1996	
398 399 400	1.7. Pr	1.7. Protocol Overview			
401	The	The following support se	services are defined for Mobile IP	le IP:	
4004 4004 4006 4006	<	Agent Discovery Home agents availability A newly arri the link to	trovery Home agents and foreign agents may advertise their availability on each link for which they provide service. A newly arrived mobile node can send a solicitation on the link to learn if any prospective agents are present.	rtise their Y provide service. solicitation on ents are present.	
400 400 400 411 412 414 414	<u>α</u>	Registration When the mobits care-of its care-of its method of either direct agent which	When the mobile node is away from home, it registers its care-of address with its home agent. Depending on its method of attachment, the mobile node will register either directly with its home agent, or through a foreign agent which forwards the registration to the home agent.	it registers . Depending on de will register through a foreign othe home agent.	
416	The	The following steps prov Mobile IP protocol:	following steps provide a rough outline of operation of the le IP protocol:	ation of the	
410 420 422 423 423	1	Mobility agents (i.e., their presence via Age mobile node may option from any locally attacl Solicitation message.	foreign agents and home nt Advertisement messages ally solicit an Agent Adv ned mobility agents throu	agents) advertise : (Section 2). A ertisement message igh an Agent	
425	,	A mobile node receiv whether it is on its	mobile node receives these Agent Advertisements and determines lether it is on its home network or a foreign network.	cs and determines network.	
428 429 430 431 432 433	,	When the mobile node detects that network, it operates without mobil to its home network from being reg node deregisters with its home age Registration Request and Registrat	When the mobile node detects that it is located on its home network, it operates without mobility services. If returnit to its home network from being registered elsewhere, the monode deregisters with its home agent, through exchange of a Registration Request and Registration Reply message with it	on its home If returning Ere, the mobile cchange of a sage with it.	
435 435 436 438 439 439		When a mobile node deternations, it obtains a crafec care-of address can agent's advertisements some external assignment acre-of address).	cts that it has moved are-of address on the either be determined (a foreign agent care- t mechanism such as Dil	to a foreign foreign network. from a foreign of address), or by CP [6] (a co-located	
444 4443 445		he mobile node oper we care-of address registration Request ossibly via a forei	The mobile node operating away from home then registers its new care-of address with its home agent through exchange of Registration Request and Registration Reply message with it, possibly via a foreign agent (Section 3).	gisters its exchange of a age with it,	
446 447 448 450	Perkins		Standards Track	[Page 8]	

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Perkins

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		October 1996	IPv4 address space e foreign network to s difficult to subnet that may	ween the care-of e-of address is ed be an address of	. Dut it might mobile node (a co- e other hand, is a odes. See Sections	t datagrams that are ered mobile nodes. cribed in serrion	e agent in section e agent has a bile node's home	ther mechanisms for e's home address.	rent foreign agent  y on standard IP  th make forwarding	if the foreign	Agent simply bypass cagrams to each ss to their of the foreign shiple using other	des, but such	tress (as described the link identified therwise, datagrams able.	ing of datagrams to bile node has ow, the mobile node	[Page 10]		
	rtc2002.txt	IP Mobility Support	It does, however, place additional burden on the IPv4 address space because it requires a pool of addresses within the foreign network to be made available to visiting mobile nodes. It is difficult to efficiently maintain pools of addresses for each subnet that may permit mobile nodes to visit.	understand the distinction becreign agent functions. The cart to the tunnel. It might indetented address.	instead be an address temporarily acquired by the mobile node (a colocated care-of address). A foreign agent, on the other hand, is a mobility agent that provides services to mobile nodes. See Sections 3.7 and 4.2.2 for additional details.	A home agent MUST be able to attract and intercept datagrams that are destined to the home address of any of its registered mobile nodes. Using the proxy and gratuitous ARP mechanisms described in Serrian	ent can be satisfied if the home on the link indicated by the mol acements of the home agent rela	node's home location MAY also be possible using other mechanisms for intercepting datagrams destined to the mobile node's home address. Such placements are beyond the scope of this document.	Similarly, a mobile node and a prospective or current foreign agent MUST be able to exchange datagrams without relying on standard IP routing mechanisms, that is, those mechanisms which make forwarding decisions based upon the network-nrefix of the destination advance.	the IP header. This requirement can be satisfied if the foreign agent and the visiting mobile node have an interface on the same	tink. In this case, the mobile node and foreign agent simply bypass their normal IP routing mechanism when sending datagrams to each other, addressing the underlying link-layer packets to their respective link-layer addresses. Other placements of the foreign agent relative to the mobile node MAY also be possible using other	mechanisms to exchange datagrams between these nodes, but such placements are beyond the scope of this document.	If a mobile node is using a co-located care-of address (as described in (b) above), the mobile node MUST be located on the link identifier by the network prefix of this care-of address. Otherwise, datagrams destined to the care-of address would be undeliverable.	For example, the figure below illustrates the routing of datagrams to and from a mobile node away from home, once the mobile node has registered with its home agent. In the figure below, the mobile node is using a foreign agent care-of address:	Standards Track		
	May 13 1998 10:38:26	507 508 RFC 2002	510 It does, however, 512 because it require 513 be made available 514 efficiently mainta 515 permit mobile node		521 instead be an addra 522 located care-of add 523 mobility agent tha 524 3.7 and 4.2.2 for a								550 If a mobile node is 551 in (b) above), the 552 by the network pref 553 destined to the car 554		560 561 562 Perkins	-	-
_													272747414				
	6 6	-				<u></u>		•					·	<u> </u>	<del>:</del>		
	rage													-			
		October 1996	ess are intercepted to the mobile 1 endpoint (either 1f), and finally	he mobile node using standard IP hrough the home	eling to hide a rs between its home minates at the ss must be an	onventional IP tagram is removed	acquisition of a	f address provided ement messages. In ss of the foreign	e endpoint of the decapsulates them node. This mode many mobile nodes	re does not place v4 address space.	ddress acquired ugh some external with one of its own ically acquired as	s through DHCP [6], cerm address for its Specific external	If IP address for use as a co-located the scope of this document. When address, the mobile node serves as the itself performs decapsulation of the	i the advantage that hign agent, for foreign agent.	[Page 9]		
rfc2002 tvt	ווכבססביועו	IP Mobility Support	Datagrams sent to the mobile node's home address by its home agent, tunneled by the home agent to node's care-of address, received at the tunnel en at a foreign agent or at the mobile node itself), delivered to the mobile node (Section 4.2.3).	In the reverse direction, datagrams sent by the mobile node are generally delivered to their destination using standard IP routing mechanisms, not necessarily passing through the home agent.	When away from home, Mobile IP uses protucol tunneling to hide a mobile node's home address from intervening routers between its home network and its current location. The tunnel terminates at the mobile node's care-of address. The care-of address must be an address.	agrams can be delivered via co e-of address, the original daidelivered to the mobile node.	Mobile 1P provides two alternative modes for the acqui	A "foreign agent care-of address" is a care-of address provided by a foreign agent through its Agent Advertisement messages. In this case, the care-of address is an IP address of the foreign	adjust. In this mode, the foreign agent is the endpoint of the tunnel and, upon receiving tunneled datagrams, decappulates then and delivers the inner datagram to the mobile node. This mode of acquisition is preferred because it allows many mobile nodes to chare the control of the control o	nds on the already limited IP.	A "cu-located care-of address" is a care-of address acquired by the mobile node as a local IP address through some external means, which the mobile node then associates with one of its own network interfaces. The address may be dynamically acquired as a femnorary address by the mobile node of the contract of the cont	by the mobile node as a long-tisting some foreign network.	mericus of acquiring a local IP address for use as a co-located care-of address are beyond the scope of this document. When using a co-located care-of address, the mobile node serves as the endpoint of the tunnel and itself performs decapsulation of the datagrams tunneled to it.	The mode of using a co-located care-of address has the advantage it allows a mobile node to function without a foreign agent, for example, in networks that have not yet deployed a foreign agent	Standards Track		
13 1998 10 38 26	0.500	RFC 2002	- Datagrams sent t by its home ager node's care-of a at a foreign age delivered to the	<ul> <li>In the reverse d are generally de routing mechanis agent.</li> </ul>	When away from home, mobile node's home a network and its curr mobile node's care-o	accuress to which dad routing. At the car from the tunnel and	Mobile 1P provides to care-of address:	<ul> <li>A "foreign agent by a foreign age this case, the c</li> </ul>	agent. In this tunnel and, upon and delivers the of acquisition if	unnecessary dema	- A "co-located ca by the mobile no means, which the network interface	or may be owned   use only while v	merhous of adquirences care-of address using a co-locate endpoint of the datagrams tunnele	The mode of using a cir allows a mobile nexample, in networks	erkins -		

45.1 45.2 45.2 45.2 45.2 46.3

Page 10

May 13 1998

265											
	October 1996	Datagram is detunneled and delivered to the mobile node.	ioreign  >   mobile   agent  >   mobile		y the requirements alized.	"required", means that e requirement of the	n is an absolute	nded", means aasons may exist plications must before choosing lts may result	<pre>l', means that this ernatives. An e this option MUST ther implementation</pre>	[Page 11]	
	IP Mobility Support	n is intercepted 3) agent and eled to the address.	home   ======   foreign  >   mobi   egent	nage	several words are used to signify the requirements on. These words are often capitalized.	This word, or the adjective 'required', means the definition is an absolute requirement of specification.	This phrase means that the definition is an absolute prohibition of the specification.	This word, or the adjective "recommended", means that, in some circumstances, valid reasons may exist to ignore this item, but the full implications must be understood and carefully weighed before choosing a different course. Unexpected results may result otherwise.	This word, or the adjective 'optional', means that this item is one of an allowed set of alternatives. An implementation which does not include this option MUST be prepared to interoperate with another implementation which does include the option.	Standards Track	
		2) Datagram by home is tunne care-of	++	ion Lang		This we the des	This pl prohib	This word, that, in s to ignore be underst a differen otherwise.	This we item is impleme be prep		
	RFC 2002		1) Daragram to mobile node arrives on home network via standard IP routing.	1.8. Specification Language	In this document, seve of the specification.	MUST	MUST NOT	Q"IOOI!S	МАУ	Perkins	

Ma	May 13 1998 10:38:26	38:26	rfc2002.txt		Page 12
619 620 621	RFC 2002	dom 91	IP Mobility Support	October 1996	
622 624 625 625 626 627 628	silenti	silently discard The implementation disca further processing, and to the sender. The impl capability of logging th of the discarded datagra in a statistics counter.	rds the datagram wi without indicating ementation SHOULD p e error, including m, and SHOULD recor	thout an error provide the the contents d the event	
631	1.9. Message F	1.9. Message Format and Protocol Extensibility	Extensibility		
633	Mobile IP defines using well-known message types are	မည့်အ	ntrol messages, Currently, the	sent with UDP [17] ! following two	
638	1 Regis 3 Regis	Registration Reguest Registration Reply			
640	Up-to-date messages ar	Up-to-date values for the message types for messages are specified in the most recent	sage types for Mobile IP control most recent "Assigned Numbers"	trol rs" (20].	
643 644 645	In addition Router Adve ICMP Router	In addition, for Agent Discove Router Advertisement and Route ICMP Router Discovery [4].	In addition, for Agent Discovery, Mobile IP makes use of t Router Advertisement and Router Solicitation messages defi ICMP Router Discovery [4].	of the existing defined for	
648 648 650	Mobile IP c information Router Disc exception)	defines a general Example to be carried by the covery messages. Exis is encoded in the f	Mobile IP defines a general Extension mechanism to allow optional information to be carried by Mobile IP control messages or by ICMP Router Discovery messages. Each of these Extensions (with one exception) is encoded in the following Type-Length-Value format:	optional r by ICMP n one Eormat:	
653 653 653 655 655	0 1 2 3 4 5 6 +++++++++++++++++++++++++++++++++++	5 6 7 8 9 0 1 2 3 4 5	4 5 6 7 8 9 0 1 2		
658	Type	Indicates the part	Indicates the particular type of Extension.		
660 661 662 663	Length	Indicates the length this Extension. The Length bytes.	rth (in bytes) of the data field within he length does NOT include the Type and	ield within the Type and	
664 665 667 668	Data	The particular dat field may be zero and length of the and length fields.	The particular data associated with this Extension. The field may be zero or more bytes in length. The format and length of the data field is determined by the type and length fields.	nsion. This ne format the type	
670 671 672 673					
674	Perkins	Stand	Standards Track	[Page 12]	
	<i>.</i>				
					-

Ма	May 13 1998 10:38:26	rfc2002.txt	Page 13	6
675 676 773	RFC 2002	IP Mobility Support:	October 1996	
673 680 681 681	Extensions allow variable each datagram. The each total longth of the IP d	Extensions allow variable amounts of information to be carried within each datagram. The end of the list of Extensions is indicated by the total length of the IP datagram.	ried within ated by the	
683 683 684	Two separately maintaine Extension Type values an	Two separately maintained sets of numbering spaces, from which Extension Type values are allocated, are used in Mobile IP:	hich ):	
686 688 688 689	- The first set consis in Mobile IP control number 434). Curren Extensions appearing	The first set consists of those Extensions which may appear only in Mobile IP control messages (those sent to and from UDP port number 434). Currently, the following Types are defined for Extensions appearing in Mobile IP control messages:	ppear only UDP port ed for	
0000	32 Mobile-Home A 33 Mobile-Foreig 34 Foreign-Home	Mobile-Home Authentication Mobile-Foreign Authentication Foreign-Home Authentication		
699 699 699 699 699	<ul> <li>The second set consists of those extens in ICMP Router Discovery messages (4). defines the following Types for Extensi Router Discovery messages:</li> </ul>	The second set consists of those extensions which may appear in ICMP Router Discovery messages (4). Currently, Mobile IP defines the following Types for Extensions appearing in ICMP Router Discovery messages:	appear only vile IP n ICMP	<del></del>
207	0 One-byte Paddi 16 Mobility Agent 19 Prefix-Lengths	One-byte Padding'(encoded with no Length nor Data field) Mobility Agent Advertisement Profix-Lengths	ta field)	
207 207 207 207 207 207 207	Each individual Extension is de section later in this document. Extension Type numbers are spec Numbers* [20].	Each individual Extension is described in detail in a separate section later in this document. Up-to-date values for these Extension Type numbers are specified in the most recent "Assigned Numbers" [20].	rate se ssigned	·
709 710 711 7112 7113	Due to the separation (orthogonality) of the conceivable that two Extensions that are def could have identical Type values. So long as may be used only in Nobile IP control messagused only in ICMP Router Discovery messages.	Due to the separation (orthogonality) of these sets, it is conceivable that two Extensions that are defined at a later date could have identical Type values, so long as one of the Extensions may be used only in Mobile IP control messages and the other may be used only in ICMP Router Discovery messages.	r date tensions er may be	
715 715 717 717 719 720 721 722	When an Extension numbered in either of these starthrough 127 is encountered but not recognized, that Extension MUST be silently discarded. Whe numbered in the range 128 through 255 is encour recognized, that particular Extension is ignore Extensions and message data MUST still be procedied of the Extension is used to skip the Data for the next Extension.	When an Extension numbered in either of these sets within the range O through 127 is encountered but not recognized, the message containing that Extension MUST be silently discarded. When an Extension numbered in the range 128 through 255 is encountered which is not recognized, that particular Extension is ignored, but the rest of the Extensions and message data MUST still be processed. The Length field of the Extension is used to skip the Data field in searching for the next Extension.	the range 0 containing ion is not rest of the Length	<del></del>
724 725 726 727 729	:			
_	200	Standards Track	[Page 13]	<del></del> -

Ma	May 13 1998 10:38:26	:38:26	rfc2002.txt		Page 14
731 732 733	RFC 2002	IP	IP Mobility Support	October 1996	
734	2. Agent Discovery	covery			
737	Agent Discovering the Agent Agents of Agents o	covery is the methan is currently corand by which a mothal is the corand corand corange.	Agent Discovery is the method by which a mobile node determines whether it is currently connected to its home network or to a foreign network, and by which a mobile node can detect when it has moved from	determines k or to a foreign it has moved from	
741	one netwo methods si determine foreign ag	one network to another. When methods specified in this sect determine the foreign agent ca foreign agent on that network.	one the work to diother. When connected to a foreign network methods specified in this section also allow the mobile node determine the foreign agent care-of address being offered by foreign agent on that network.	network, the ile node to fered by each	
746	Mobile IP for Agent Mobility / Advertised is identic MUST be se formats ar	Mobile IP extends ICMP Router Discover; for Agent Discovery. An Agent Advertism Mobility Agent Advertisement Extension Advertisement message (Section 2.1). As identical to an ICMP Router Solicity MOST be set to 1 (Section 2.2). This is formats and procedures by which mobile home agents cooperate to realize Agent	Mobile IP extends ICMP Router Discovery [4] as its primary mechanism for Agent Discovery. An Agent Advertisement is formed by including a Mobility Agent Advertisement Extension in an ICMP Router. Advertisement message (Section 2.1). An Agent Solicitation message is is identical to an ICMP Router solicitation, except that its IP TTL MUST be set to 1 (Section 2.2). This section describes the message formats and procedures by which mobile nodes, foreign agents, and home agents cooperate to realize Agent Discovery.	imary mechanism ed by including a ter. Itation message that its IP TL bes the message age the ages and agents, and	
754 755 756 757 758 759	Agent Adve link layer which mobi agents is The procec	Agent Advertisement and Agent Solicitation link layers that already provide this fund which mobile nodes establish link-layer co agents is outside the scope of this docume The procedures described below assume that connectivity has already been established.	Agent Advertisement and Agent Solicitation may not be necessary for link layers that already provide this functionality. The method by which mubile nodes establish link-layer connections with prospective agents is outside the scope of this document (but see Appendix B). The procedures described below assume that such link-layer connectivity has already been established.	inecessary for The method by With prospective Appendix B).	
761 762 763 764 765	No authent Solicitati Authentica described which Adve outside of	No authentication is requir Solicitation messages. The Authentication Header [1], described in this document. Which Advertisement and Sol outside of the scope of thi	No authentication is required for Agent Advertisement and Agent Solicitation messages. They MAY be authenticated using the IP Authentication Header [1], which is unrelated to the messages described in this document. Further specification of the way in which Advertisement and Solicitation messages may be authenticated outside of the scope of this document.	and Agent ng the 1P messages the way in authenticated is	
768	2.1. Agent Advertisement	lvertisement			
777 777 777 777 775 777 877	Agent Adveits service determine Agent Adveer taded textended textended textended textended textended textensions	ertisements are trass on a link. Moi their current poi trissement is an II of o also carry an Moi trissement private and option. I.l. I) and option that might be de	Agent Advertisements are transmitted by a mobility agent to advertise its services on a link. Mobile nodes use these advertisements to determine their current point of attachment to the Internet. An Agent Advertisement is an ICMP Router Advertisement that has been extended to also carry an Mobility Agent Advertisement Extension (Section 2.1.1) and optionally. A prefix-Lengths Extension (Section 2.1.3), one-byte Padding Extension (Section 2.1.3), or other Extensions that might be defined in the future.	ent to advertise tisements to ternet. An hat has been t Extension ension (Section r other	
779 780 781 782 783	Within an fields of additional	Agent Advertisementhe message are ruspecifications:	Within an Agent Advertisement message, ICMP Router Advertisement fields of the message are required to conform to the following additional specifications:	vertisenent following	
784 785 786	Perkins	Str	Standards Track	[Page 14]	
	<del>-</del> .				

May 13	May 13 1998 10:38:26	38:2	26 rfc2002.txt	Page 15	Ma	May 13 1998 10:38:26	:26
	KFC 2002		IP Mobility Support October 1996		843	RFC 2002	
790	- Link-	-Layer	Link-Layer Fields		846	Mum Action	د بر
793	De	stinat	Destination Address		848		T.
794 795 796 797			The link-layer destination address of a unicast Agent Advertisement MUST be the same as the source link-layer address of the Agent Solicitation which prompted the Advertisement.		88 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8		me th
798	IP Fields	splas		<del></del>	85.54 4.74	If sent periodical	pdica
801 802	LLF	릴	The TTL for all Agent Advertisements MUST be set to 1.		856 857 857	given in the ICMP   successive advertis	ICME
803 804 805 807 809 810	De	est inat.	Destination Address As specified for ICMP Router Discovery [4], the IP destination address of an Agent Advertisement MUST be either the "all systems on this link" multicast address (224,00.1) [5] or the "limited broadcast address (255,255,255,755). The submet-directed broadcast address of the form sprefix>.<-1> cannot be		8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	Valid agents. The Valid agents. The SHOULD be slightly and subsequent col. sent by other agent other routers). New Registration Life Extension defined by Ament 2.1.1. Mobility Ament	ightlightlit age s).  Liftined
8 8 2 2 3 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4		:			868 868	The Mobility Agent	Agen
8 8 1 5 8 1		ICML Fields Code	-		870 871 871	Advertisement ingle Advertisement messe mobility agent. The	mes Tr.
H18 820 821 821 823 823 823			O The mobility agent handles common traffic that is, it acts as a router for IP datagrams not necessarily related to mobile nodes.  16 The mobility agent does not route common traffic. However, all foreign agents MUST (minimally) forward to a default router any datagrams received from a reqistered mobile node (Sertion 4.2.)		873 874 875 876 877 878 878 879	0 0 1 2 3 4 5 6 7 8	6 7 6 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
827 827 828 839 830	<u>:</u>	Lifetime			888 882 883 884 884 885		16
833 833 836 836 836	Rou	uter A	Router Address(es) See Section 2.3.1 for a discussion of the addresses that may appear in this portion of the Agent Advertisement.		888 888 890 891 891	Sequence M.	adverti Mumber The cou
840 841 842 Perkins	ins		Standards Track (Page 15)		8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	Perkins	
						e .	
					·		

Ma	May 13 1998 10:38:26	rfc2002.txt	Page 16
843 844	RFC 2002 IP Mobi	Mobility Support October 1	9661
846 848 849 849 850 851	Num Addrs The number of Router message. Note that message, the number the ICMP Router Adve	c Addresses advertised in this in an Agent Advertisement of router addresses specified extisement portion of the messes Section 2.3.1 for details.	in ge
**************************************	If sent periodically, the nominal interval Advertisements are sent SHOULD be 1/3 of th given in the ICMP header. This allows a mc successive advertisements before deleting to valid agents. The actual transmission time SHOULD be slightly randomized (4) in order and subsequent collisions with other Agent sent by other agents (or with other Agent other touters). Note that this field has new Registration Lifetime* field within the Mc Extension defined below.	the advertisement Lifetin mobile node to miss three if the agent from its list me for each advertisements to avoid synchronization advortisements that may and advortisements sent by no relation to the Mobillity Agent Advertisem	e of
865 866 867	2.1.1. Mobility Agent Advertisement Extension	nt Extension	
868 869 870 871 872	The Mobility Agent Advertisement Advertisement fields. It is used Advertisement message is also an mobility agent. The Mobility Age defined as follows:	isement Extension follows the ICMP Router: is used to indicate that an ICMP Router also an Agent Advertisement being sent by ility Agent Advertisement Extension is	æ
874 874 875 876 877 879 880 881 881	0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 4 + + + + + + + + + + + + + + + + +	1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 1 2 3 4 5 6 7 8 9 0 1 1 3 4 5 6 7 8 9 9 0 1 1 3 4 5 6 7 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	
3883	Type 16	_	
886	Length (6 + 4*N), where N advertised.	where N is the number of care-of addresses	
88888888888888888888888888888888888888	Sequence Number The count of Agent agent was initializ	of Agent Advertisement messages sent since the initialized (Section 2.3.2).	
895 895 896			
868	Perkins Standa	Standards Track [Page 16]	
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May 13	May 13 1998 10:38:26	18:26	rfc2002.txt	Pa	Page 17	May 1	May 13 1998 10:38:26
899 900 RFC 901	RFC 2002	1P Mobi	IP Mobility Support Octo	October 1996		1	RFC 2002
903 904 905 406 907	Registra	Registration Lifetime The longest lifeting agent is willing to A value of Ostflitt relation to the "L Advertisement port	ion Lifetime The longest lifetime (measured in seconds) that this agent is willing to accept in any Registration Request. A value of Oxifif indicates infinity. This field has no relation in the 'Lifetime' field within the ICMP Router Advertisement portion of the Agent Advertisement.	his quest. has no Router		958 960 961 962 963	agent may indicate register with it, An Agent Advertise 'F' bit is not also bit NUST be set in
910	œ	Registration required agent for another rather than using	Registration required. Registration with this foreign agent for another foreign agent on this link) is required rather than using a co-located care-of address.	reign reguired		965 967 968	When a foreign ages mobile nodes which sets the 'R' bit agents an agent M
2 6 9 9 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	æ	Busy. The foreign agent will from additional mobile nodes.	The foreign agent will not accept registrations ddirional mobile nodes,	tions			is also set to one
917 918 919	æ	Home agent. This on the control of the link on which sent.	Home agent. This agent offers service as a home agent on the link on which this Agent Advertisement message is sent.	agent sage is			The Prefix-Lengths Advertisement Exter
921 923 923	ir.	Foreign agent. Thi agent on the link o message is sent.	Foreign agent. This agent offers service as a foreign agent on the link on which this Agent Advertisement message is sent.	reign ıt		976 977 978 979	ICMP Router Advertituate the prefix leading listed in the Mobil Lengths Extension in
925 926 927	Ξ	Minimal encapsulation. tunneled datagrams that	Minimal encapsulation. This agent implements receiving tunneled datagrams that use minimal encapsulation (15).	siving (15).	· · · ·	980 981 982	0 1 2 3 4 5 6 7 8
928 929 930	ט	GRE encapsulation. tunneled datagrams	GRE encapsulation. This agent implements receiving tunneled datagrams that use GRE encapsulation [8].	Ďi		983 984 985	Type   Type
931 932 933 933	>	Van Jacobson header of Van Jacobson hea with any registered	Van Jacohson header compression. This agent supports use of Van Jacohson header compression [10] over the link with any registered mobile node.	rts use ink	<del></del>	986 988 988	Type 19 (Pre
935 936 937	reserved	Sent as zero; ignored on reception.	red on reception.			990 991 992	
, 4 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	Care-of A	Cate-of Address(us) The advertised foreign a by this foreign agent. include at least one cat is set. The number of determined by the Lengtl	Widness(us) The advertised foreign agent care-of address(es) provided by this foreign agent. An Agent Advertisement MUST include at least one care-of address; if the 'F' bit is set. The number of care-of addresses present is determined by the Length field in the Extension.	rovided T t s		9993 9995 9996 9998	Prefix Length(s) The num of the Router length byte, in the
	home agent hich it is o serve add gent Advert ith it will oreign agen	the home agent. A fitzional mobile mode is a fixenents, so that a know that they have the fixenents and that the fore	A houme agent MUST always be prepared to serve the mobile nodes for which it is the home agent. A foreign agent may at times be too busy to serve additional mobile nodes; even so, it must continue to send Agent Advertisements, so that any mobile nodes already registered with it will know that they have not moved out of range of the foreign agent and that the Foreign agent has not failed. A foreign	for oo busy send red reign		1000 1001 1002 1003 1004 1005	See Section 2.4.2 f Extension MAY be us has moved. See App of this Extension.
952 953 954 Perkins	ins	Standa	Standards Track (P	, [Page 17]		1007 1008 1009 1010 Per	Perkins
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Ma	May 13 1998 10:38:26	rfc2002.txt	Page 18
955 956 957 957	RFC 2002	IP Mobility Support	October 1996
9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	agent may indicate register with it, I. An Agent Advertiser 'F' bit is not also bit NUST be set in	agent may indicate that it is "too busy" to allow new mobile nodes to register with it. by setting the 'B' bit in its Agent Advertisements. An Agent Advertisement message MUST NOT have the 'B' bit set if the 'F' bit is not also set, and at least one of the 'F' bit and the 'H' bit NUST be set in any Agent Advertisement message sent.	mobile nodes to Advertisements. it set if the iit and the 'H'
966 966 968 968	When a foreign agen mobile nodes which sets the 'R' bit to agents, an agent MU is also set to one.	When a foreign agent wishes to require registration even from those mobile nodes which have acquired a co-located care-of address, it sets the 'R' bit to one. Because this bit applies only to foreign agents, an agent WUST NOT set the 'R' bit to one unless the 'F' bit is also set to one.	en from those address, it y to foreign s the 'F' bit
971	2.1.2. Prefix-Lengths Extension	Extension	
973 975 976 976 978	The Prefix-Lengths Extension. Odvertisement Extension. of network prefix that at ICMP Router Advortisement that the prefix lengths of listed in the Mobilitry Agrension is deficenths Extension is deficenths	The Prefix-Lengths Extension MAY follow the Mobility Agent Advertisement Extension. It is used to indicate the number of bits of network prefix that applies to each Router Address listed in the CIOMP Router Advertisement portion of the Agent Advertisement. Note that the prefix lengths given DO NOT apply to care-of address(es) listed in the Mobility Agent Agent Extension. The Prefix-Lengths Extension as follows.	gent umber of bits listed in the Sement. Note address(es) The Prefix-
9822 1 0 882 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 2 3 4 5 6 7 8 4 5 4 5 6 7 8 4 5 6 7 8 4 5 6 7 8 4 5 6 7 8 4 5 6 7 8 4 5 6 7 8 4 5 6 7 8 6 7	2 0 1 2 3 4 5 +-+-+++++++++++++++++++++++++++++++++	6 7 8 9 0 1 -++-+++++
987	Type 19 (Pre	9 (Prefix-Lengths Extension)	
9890	Length N, where N is the ICMP Route Advertisement.	N, where N is the value of the Num Addrs field in the ICMP Router Advertisement portion of the Agent Advertisement.	ieJd in ne Agent
9999 9999 9999 1999	Prefix Length(s) The numb of the of the c Router A length i byte, ii	INCIPIES  The number of leading bits that define the network number of the corresponding Router Address listed in the ICHP ROUTER Advertisement portion of the message. The prefix length for each Router Address is encoded as a separate byte, in the order that the Router Addresses are listed in the ICMP Router Advertisement portion of the message.	network number in the ICMP P. The prefix is a separate is are listed
1002 1003 1004 1004 1005 1006	See Section 2.4.2 fc Extension MAY be use has moved. See Appe of this Extension.	See Section 2.4.2 for information about how the Prefix Lengths Extension MAY be used by a mobile node when determining whether it has moved. See Appendix E for implementation details about the usof this Extension.	Lengths whether it bout the use
1010	Perkjus	Standards Track	(Page 18)

Ma	May 13 1998 10:38:26 rfc2002.txt	Page 19	May 13	May 13 1998 10:38:26
7770	PF: 2002 IP Mobility Support October 1996	96	.[	RFC 2002
2 2 2	2.1.3. one-byte Padding Extension		1070	- a mobility agen
1017		ţœ	1072	require that the tile., an addre
6101		ke be	1075	on the arrival that address of
1022	o special proper extension to be included in order to word- or long-align the various fields of the Agent Advertisement. An Agent Advertisement. An Agent because its example for include more than one one-byte Padding		1077 1078 1079	<ul> <li>a mobility ager only in respons</li> </ul>
1025		uo		If the home networb any mobile node SHC
1027 1028 1029	Note that unlike other Extensions used in Mobile IP, the One-byte Padding Extension is encoded as a single byte, with no 'Length' nor 'Data' [ield present the One-bure model: per content to the One-bure model in the One-bure model			mobile node's home the home agent on t mobile nodes on the
1030				they are indeed at the home agent on a
1032	0 1 2 3 4 5 6 7			a mobility agent se bit set, unless the
1035	1,450			incline home network
1037	Type 0 (One-byte Padding Extension)			physical realization case, there is no p
1039	2.2. Agent Solicitation			Advertisement messa which this is the h
1041	An Avent Solicitation is identical to an ICMP Router Solicitation with the further restriction that the IP TTL Field MUST he set to	1.		home. On a narricular cub
0 0 0	2.1. Foreign Agent and Home Agent Considerations			on a particular sum Prefix-Lengths Exte Extension. Equival
1046	Any mobility agent which cannot be discovered by a link-layer protocol MUST send Agent Advertisements. An agent which can be			subnet to include to Otherwise, one of t
1049	discovered by a link-layer protocol SHOULD also implement Agent Advertisements. However, the Advertisements need not be sent, excludent the site polity requires registration with the agent (i.e., when the site polity requires registration with the agent (i.e., and the same of the s	- L	2.	2.3.1. Advertised Rout
1051 1052 1053	the 'R' bit is set), or as a response to a specific Agent Solicitation. All mobility agents SHOULD respond to Agent Solicitations.	=	1107 TE	The ICMP Router Adv
1055 1055 1057 1058	The same procedures, defaults, and constants are used in Agent Advertisement messages and Agent Solicitation messages as specified for ICMP Router Discovery [4], except that:			of the own addressed discourage use of the preference to a low router in the advertored
1059 1060 1061	<ul> <li>a mobility agent MUST limit the rate at which it sends broadcast or multicast Agent Advertisements; a recommended maximum rate is once per second, AMD</li> </ul>			_
1063 1064 1065		-	1118	
1066	Perkins Standards Track (Page 19)		1121   1122   Perkins	ns

1966 REC 2002 IP Mobility Support Coctober 1996 1970 1971 1972 1973 1974 1975 1975 1975 1975 1975 1975 1975 1975	_						I
2 3 1 2 1 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1	1067	RFC	02	IP Mobility Supp		tober 1996	
2	1070						
2	1071	'	a mobility agent	that receives a Ro	outer Solicitation MU	ST NOT	
2 3 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1073	· m -	(i.e., an addres	s that matches one	of the router's own a	neighbor addresses	
Perk	1075	•••	on the arrival i that address of	nterface, under the the router).	subnet mask associal	ted with	
2 3 3 Perk	1077		a mobility agent	MAY be configured	to send Agent Advoct	1	
2.3 3 Perk	1078	<b>.</b>	only in response	to an Agent Solici	tation message.	Sements	
2.3 2.3 Perk	1080		the home network	is not a virtual ne	twork, then the home	agent for	
Perh	1081		mobile node SHOU	LD be located on th	e link identified by	the	
Per's	1083		home agent on th	is link MUST have r	dvertisement message: he 'H' bit oot II	s sent by	
Perk	1084		ile nodes on thei	r own home network	will be able to deter	mine that	
2.3	1085		are indeed at h	ome. Any Agent Adv	ertisement messages	sent by	
hit set, unless the home agent also serves a mobile nodes) on that other link.  If the home network is a virtual network, the physical realization external to the home age case, there is no physical network link on wheterisement messages advertising the home which this is the home network are always trubome.  On a particular subnet, either all mobility are fix-Lengths Extension or all of them MUST Extension. Equivalently, it is prohibited for other otherwise, one of the move detection algorith nodes will not function properly (Section 2, 13.1. Advertised Router Addresses. Thus, of its own addresses in the advertisement. Preference to a low value and by including the preference to a low value and by including the router in the advertisement (with a correspondiscourage use of this address as a default, preference to a low value and by including throuter in the advertisement (with a correspondiscourage use from registered mobile nodes (Section 1. Tecivos from registered mobile nodes (Section 1. Tecivos from registered mobile nodes (Section 2. Tecivos fr	1087		nome agent on an ability agent ser	other link to which	it may be attached	if it is	
mobile nodes) on that other link.  If the home network is a virtual network, the physical realization external to the home aga case, there is no physical network link on which this is the home network are always trucher.  On a particular subnet, either all mobility a Prefix-Lengths Extension or all of them WUST Extension or all of them or the Otherwise, one of the move detection algorith under will not function properly (Section 2).  2.3.1. Advertised Router Addresses. Thus, of its own addresses in the advertisement, a discourage use of this address as a default. Preference to a low value and by including the router in the advertisement (with a corresponderence). Nevertheless, a foreign agent breference). Nevertheless, a foreign agent breceives from registered mobile nodes (Section 2).  Perkins	1088		set, unless the	home agent also ser	tink), Musi Nor have	the 'H'	
If the home network is a virtual network, the physical realization external to the home agraes. There is no physical network link on what Advertisement messages advertising the home which this is the home network are always transment.  On a particular subnet, either all mobility a prefix-Lengths Extension or all of them MUST Extension. Equivalently, it is prohibited for subnet to include the Extension but for other other include the Extension but for other other will not function properly (Section 2.3.1. Advertised Router Addresses. Thus, of its own addresses in the advertisement. For the contain one or more router addresses. Thus, of its own addresses in the advertisement. For the couter in the advertisement (with a correspond receives from registered mobile nodes (Section Perkins).  Perkins Standards Track  Standards Track  Standards Track	1089		le nodes) on tha	t other link.	אבש מש מחחווה מחפונו (	to other	
If the Mone network is a virtual network, the physical realization external to the home agracase, there is no plysical network link on which this is the home network are always transmitch this is the home network are always transmitch this is the home network are always transmitch the prefix-Lengths Extension or all of them MUST Extension. Equivalently, it is prohibited for submet to include the Extension but for other other orders, one of the move detection algorithmed for the property of the mover and of the contain one or more router addresses.  The ICMP Router Advertisement portion of the contain one or more router addresses. Thus, of its own addresses in the advertisement. Addresses the preference to a low value and by including the preference to a low value and by including the receives from registered mobile nodes (Section Sections).  Perkius Standards Track Standards Track	1090						
Advertisement messages advertising the home agrand to this is the home network link on which this is the home network are always transmitted the prefix-lengths Extension or all of them MUST.  By a particular subnet, either all mobility of the forest on the forest of the move detection algorithm of the forest on the forest on the forest on the forest on of the move detection algorithm ondes will not function properly (Section 2.4.). Advertised Router Addresses  The ICMP Router Advertisement portion of the contain one or more router addresses. Thus, of its own addresses in the advertisement of the own addresses in the advertisement. I discourage use of this address as a default preference to a low value and by including the preference to a low value and by including the preference. Nevertheless, a foreign agent because from registered mobile nodes (Section 1.1.). The foreign agent because the foreig	1001		the home network	is a virtual networ	k, the home network h	ias 110	
Advertisement messages advertising the home which this is the home network are always trahome.  On a particular subnet, either all mobility a Prefix-Lengths Extension or all of them MUST Extension. Equivalently, it is prohibited for the move detection algorith subnet to include the Extension but for other otherwise, one of the move detection algorith nodes will not function properly (Section 2. 2.3.1. Advertised Router Addresses. Thus, of its own addresses in the advertisement. A fins, of its own addresses in the advertisement. Preference to a low value and by including the router in the advertisement (with a correspon preference). Nevertheless, a foreign agent between the advertisement from receives from registered mobile nodes (Section 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	1093		there is no ph	external to the ho	me agent itself. In	this	
which this is the home network are always trubume.  On a particular subnet, either all mobility a Prefix-Lengths Extension or all of them MUST Extension. Equivalently, it is prohibited for subnet to include the Extension but for other otherwise, one of the move detection algorith nodes will not function properly (Section 2.2.3.1. Advertised Router Advertisement portion of the contain one or more router addresses. Thus, of its own addresses in the advertisement. Preference to a low value and by including the preference to a low value and by including throuter in the advertisement (with a correspon preference). Nevertheless, a foreign agent breeference). Nevertheless, a foreign agent breeference.  Perkins Standards Track Standards Track	1094		rtisement messag	es advertising the	bone agent Mobile n		
nome.  On a particular subnet, either all mobility of Prefix-Lengths Extension or all of them WUST Extension or all of them WUST Extension or all of them WUST Extension requivalently, it is prohibited for subnet to include the Extension but for other Otherwise, one of the move detection algorith under will not function properly (Section 2.2.3.1. Advertised Router Addresses. Thus, of its own addresses in the advertisement. I preference to a low value and by including the router in the advertisement (with a correspon preference to a low value and by including throuter in the advertisement (with a correspon preference). Nevertheless, a foreign agent breceives from registered mobile nodes (Section Registered mobile nodes (Section Registered Mobile nodes).	1095		th this is the ho	me network are alwa	ys treated as being a	-	
On a particular subnet, either all mobility artension or all of them MUST Extension or all of them MUST Extension beguivalently, it is prohibited traubmet to include the Extension but for other Otherwise, one of the move detection algorith undes will not function properly (Section 2.2.3.1. Advertised Router Addresses  The ICMP Router Advertisement portion of the contain one or more router addresses. Thus, of its own addresses in the advertisement. Adiscourage use of this address as a default, preference to a low value and by including throuter in the advertisement (with a correspond preference). Nevertheless, a foreign agent breceives from registered mobile nodes (Section Perkins)  Perkins  Standards Track	1097						
Perfix-Lengths Extension or all of them MUST Extension. Equivalently, it is prohibited for submet to include the Extension but for other otherwise, one of the move detection algorithm of the move detection algorithm of the move detection algorithm or the contain one or more router addresses. Thus, of its own addresses in the advertisement of its own addresses in the advertisement of its own addresses in the advertisement. Addresses as a default proference to a low value and by including the preference to a low value and by including the preference. Nevertheless, a foreign agent preference. Nevertheless, a foreign agent receives from registered mobile nodes (Section Services).	1098		narticular subm	or soithor			
Extension. Equivalently, it is prohibited is subnet to include the Extension but for other Otherwise, one of the move detection algorithmodes will not function properly (Section 2.4.2.3.1. Advertised Router Addresses  The ICMP Router Advertisement portion of the contain one or more router addresses. Thus, of its own addresses in the advertisement. I discourage use of this address as a default, preference to a low value and by including it preference to a low value and by including the preference in the advertisement (with a corresponder preference). Nevertheless, a foreign agent by receives from registered mobile nodes (Section Registered mobile nodes (Section Registered mobile nodes).	1099		ix-Lengths Exten	sion or all of them	MUST NOT include thi	ude the	
Subnet to include the Extension but for other otherwise, one of the move detection algorith nodes will not function properly (Section 2.2.3.1. Advertised Router Addresses.  The ICMP Router Advertisement portion of the contain one or more router addresses. Thus, of its own addresses in the advertisement. Adscourage use of this address as a default. Preference to a low value and by including throuter in the advertisement (with a correspond preference). Nevertheless, a foreign agent by receives from registered mobile nodes (Section 1.2.).  Perkins Standards Track	1100		ınsion. Equivale	ntly, it is prohibi	ted for some agents o	n a given	
Underwise, one of the move detection algorith modes will not function properly (Section 2.2.3.1. Advertised Router Addresses  The ICMP Router Advertisement portion of the contain one or mover couter addresses. Thus, of its own addresses in the advertisement. Preference to a low value and by including the router in the advertisement (with a correspon preference). Nevertheless, a foreign agent preference). Nevertheless, a foreign agent receives from registered mobile nodes (Section Rewins Standards Track	1101		et to include the	e Extension but for	others not to includ	e it.	
2.3.1. Advertised Router Addresses The ICMP Router Advertisement portion of the contain one or more router addresses. Thus, of its own addresses in the advertisement. Perference to a low value and by including the preference to a low value and by including the router in the advertisement (with a corresponder in the advertisement (with a corresponder in the advertises, a foreign agent breference). Nevertheless, a foreign agent breceives from registered mobile nodes (Section Registered mobile nodes (Section Registered mobile nodes (Section Registered mobile nodes).	1103		rwise, one of the	e move detection al	gorithms designed for	mobile	
2.3.1. Advertised Router Addresses  The ICMP Router Advertisement portion of the contain one or more router addresses. Thus, of its own addresses in the advertisement. I discourage use of this address as a default. Preference to a low value and by including the router in the advertisement (with a correspond preference). Nevertheless, a foreign agent breceives from registered mobile nodes (Section Perkins Standards Track	1104		2011	ion property (secur	on 2.4.2).		
The ICMP Router Advertisement portion of the contain one or more router addresses. Thus, of its own addresses in the advertisement. I discourage use of this address as a default. Preference to a low value and by including the router in the advertisement (with a correspond preference). Nevertheless, a foreign agent receives from registered mobile nodes (Section Perkins).	1105		Advertised Route	r Addresses			
contain one or more router addresses. Thus, of its own addresses in the advertisement. A discourage use of this address as a default, preference to a low value and by including the router in the advertisement (with a correspon preference). Nevertheless, a foreign agent breceives from registered mobile nodes (Section Perkins Standards Track	1107		TCMP Router Adva	110000000000000000000000000000000000000			
of its own addresses in the advertisement. Adsorvage use of this address as a default preference to a low value and by including througer in the advertisement (with a correspond preference). Nevertheless, a foreign agent breceives from registered mobile nodes (Secting Secting Section S	1108		ain one or more	resement portion o	I the Agent Advertise	ment MAY	
discourage use of this address as a default router by setting preference to a low value and by including the address of an router in the advertisement (with a correspondingly higher preference). Nevertheless, a foreign agent NUST route datagreceives from registered mobile nodes (Section 4.2.2).  Perkins Standards Track	1109		ts own addresses	in the advertisemen	nt. A foreign agent	CIUGE ONE	
preference to a low value and by including the address of an router in the advertisement (with a correspondingly higher preference). Nevertheless, a foreign agent NUST route datag receives from registered mobile nodes (Section 4.2.2).  Perkins Standards Track	1110		ourage use of the	is address as a defe	ault router by settin	rha G the	
router in the advertisement (with a correspondingly higher preference). Nevertheless, a foreign agent NUST route datag receives from registered mobile nodes (Section 4.2.2).  Perkins Standards Track	1111		erence to a low	value and by includ	ing the address of an	g the	
Preference). Nevertheless, a foreign agent NUST route datagreceives from registered mobile nodes (Section 4.2.2).  Perkins Standards Track	1117		er in the advert	isement (with a corn	respondingly higher		
Perkins Standards Track	1113		erence). Neverti	neless, a foreign ag	yent MUST route datag	rams it	
Perkins Standards Track	1114		1Ves from regist(	ered mobile nodes (3	Section 4.2.2).		
Perkins Standards Track	1116						
Perkins Standards Track .	1117						
Perkins Standards Track .	1118						
Perkins Standards Track .	1119						
Perkins Standards Track	1120						
	1122			Standarde Trad			
				Scandards 11 acr		[Page 20]	
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Page 20

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Page 21											-															 
	October 1996		s from 0 to Oxffff. its first T use the sequence	equence number In this way, mobile ers that result from	of the sequence		on. Solicitations	link-layer protocol	for ICMP Router node MAY solicit	AY solicit more	se MIST be limited	ee initial	Lions are sent MUST al link. Subsement	tial backoff ive Solicitations,	OULD be chosen te media over which	cval SHOULD be at	de MUST NOT increase	: has received a nk. After	s node SHOULD also lons when it next	jister. The mum rate, but then	all cases, the ues. Mobile nodes	se nominal values			[Page 21]	
rfc2002.txt	IP Mobility Support	nd Rollover Handling	The sequence number in Agent Advertisements ranges from 0 to Oxffff. After booting, an agent MUST use the number 0 for its first advertisement. Each subsequent advertisement MUST use the sequence	Number one gradue, with the exception that the sequence number OKIĞİK MUST be followed by sequence number 256. In this way, mobile moddes can distinguish reductions in sequence numbers that result from	ns that result in rollover s the value OxfffF.	ations	Every mobile node MUST implement Agent Solicitation. SHOULD only be sent in the absence of Agent Advertis	care of address has not been determined through a link-layer protocol or other means. The mobile node uses the same procedures, defaults,	and constants tot Agent Solicitation as specified for ICMP Router Solicitation messages [4], except that the mobile node MAY solicitation work often than once every lires secunds and that a mobile model.	cted to any foreign agent M.	bile node sends Solicitation	he mobile node MAY send thri imum rate of one per second	an agent. After this, the rate at which Solicitations are sent William be reduced so as to limit the overhead on the local link. Subsemmen	sent using a binary exponent e interval between consecut:	up to a maximum interval. The maximum interval SHOULD be chosen appropriately based upon the characteristics of the media over wh	iciting. This maximum interval en Solicitations.	While still searching for an agent, the mobile node MUST NOT increase	the face at which it sends Solicitations unless it has received a positive indication that it has moved to a new link. After	successinily registering with an agent, the mobile node SHOULD also increase the rate at which it will send Solicitations when it next	regins searching for a new agent with which to register. The increased solicitation rate MAY revert to the maximum rate. But them	MUST be limited in the manner described above. In all cases, recommunded solicitation intervals are nominal values. Mobile	olicitation times around the Router Discovery (4).			Standards Track	
May 13 1998 10:38:26	KFC 2002	2.3.2. Sequence Numbers and Rollover Handling	The sequence number in After booting, an agen advertisement. Each s	number one greater, wi Oxffft MHST be followe modes can distinguish	reboots, from reductio number after it attain	2.4. Mobile Mode Considerations	Every mobile node MUST SHOULD only be sent in	care of address has no or other means. The m	and constants for Agen Solicitation messages more often than once e	is currently not connected to Limes than MAX_SOLICITATIONS.	The rate at which a mol	by the mobile node. The Solicitations at a max	an agent. After this, be reduced so as to lin	Solicitations MUST be mechanism, doubling the	up to a maximum interva	the mobile node is soliciting. This ma least one minute between Solicitations	While still searching	positive indication the	increasementy registering increase the rate at wh	begins searching for a increased solicitation	MUST be limited in the recommended solicitation	MUST randomize their solicitation times aro as specified for ECMP Router Discovery (4).			Perkins	
Maj	1123 1124 1125 1126	1127	60 E E	355	2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	28 5	1140	142	1145	1147	1149	1151	1153	1156	1158	1160	162	1164	9911	1168	0211	12.5	17.5	11.70	1178	

Ma	y 13	May 13 1998 10:38:26	rfc2002.txt	Page 22
1179	RFC	2002	IP Mobility Support October 19	1996
1183 1184 1186 1186 1186 1189 1190		Mobile nodes MUST process received Agent Advended can distinguish an Agent Advertisement nof the ICMP Router Advertisement message by eadvertised addresses and the IP TOTAL Length total length indicates that the ICMP message for the number of advertised addresses, the interpreted as one or more Extensions. The Agent Advertisement Extension identifies the Agent Advertisement.	Mobile nodes MUST process received Agent Advertisements. A mobile node can distinguish an Agent Advertisement message from other uses of the ICMP Router Advertisement message by examining the number of advertised addresses and the IP Total Length field. When the IP total Length indicates that the ICMP message is longer than needed for the number of advertised addresses, the remaining data is interpreted as one or more Extensions. The presence of a Nobility Agent Advertisement Extension identifies the advertisement as an	<b>7</b> .00
1193 1194 11195 11196 11197 11199	N A A A A A A A A A A A A A A A A A A A	When multiple methods of agent discovery are in SHOULD first attempt registration with agents i Agent Advertisement Extensions in their adverti to those discovered by other means. This prefe likelihood that the registration will be recogni minimizing the number of registration attempts.	When multiple methods of agent discovery are in use, the mobile node SHOULD first attempt registration with agents including Mobility Agent Advertisement Extensions in their advertisements, in preference to those discovered by other means. This preference maximizes the likelihood that the registration will be recognized, thereby minimizing the number of registration attempts.	e e e e e e e e e e e e e e e e e e e
1202 1203 1204 1204 1205 1206	* n 3 n > u	When the mobile node receiver, the mobile node SHOUGLE when the mobile node might care-of address. This feat visiting polities (such as authorization.	When the mobile node receives an Agent Advertisement with the 'R' bit set, the mobile node SHOULD register through the foreign agent, even when the mobile node might be able to acquire its own co-located care-of address. This feature is intended to allow sites to enforce authorization.	it e e
1209	2.4.	2.4.2. Move Detection		
1211 1212 1213 1213 1214 1216 1216 1217 1218	Wh. 3 0 0 1 1	Two primary mechanisms are provided for mobi- they have moved from one subnet to another. also be used. When the mobile node detects SHOULD register (Section 3) with a suitable new foreign network. However, the mobile no frequently than once per second on average, 3.6.3.	Two primary mechanisms are provided for mobile nodes to detect when they have moved from one subnet to another. Other mechanisms MAY also be used. When the mobile node detects that it has moved, it SHOULD register (Section 3) with a sulfable care-of address on the new foreign network. However, the mobile node NUST NOT register more frequently than once per second on average, as specified in Section 3.6.3.	נס
1223 1223 1223 1223 1223 1226 1229 1233 1233 1233 1233 1233	Perkins		Standards Track   Page 2	22.1

Page 23		
	the Lifetime field ment portion of the Lifetime expires. Lifetime expires. Lisement from the Lifetime expires. Lisement from the Lisement carely Lix-Lengths Lix-Lengths Lix a mobile node is Lit has mevored. If a mobile node is Lithis Extension Lithis Extension Lithis method of Lefix-Lengths Lithis method of Lefix-Lengths Lithis method of Lefix-Lengths Lithis method of Lefix-Lengths Lisement care-of Lithis method of L	rage 23
rfc2002.txt	The Mobility Support  the ICMP Router Advertisem mabile node SiDOLLD record Wher isements, until that Last or receive another advert secified Lifetime, it SHOUL not advent. If the mobile not at agent. If the mobile not for expired, the mobile not liscover a new agent. Other liscover a new agent care- nobile node's current care- sectived Agent Advertisements, for the advertisements, for the advertisements, for bewagent includes the Prectove Agent and the mobile node sement and the mobile node sement and the mobile node sement and the mobile node for of address, it SHOULD not for any address, it SHOULD not for not address for ad	
May 13 1998 10:38:26	The first merbol of move detection is based upon the Lifetime field within the main body of the ICMP Router Advertisement portion of the received in any Advertisement. A mable mode SIDUUD record the Lifetime capties. If the mobile mode SIDUUD record the Lifetime received in any Advertisements, until that Lifetime expires. If the mobile mode Router Advertisement from the same again vithin the specified Lifetime. It should assume that it is some that it work the mobile mode any Advertisement from the rifetime (led has not yet expired, the mobile mode has proviously item a not her advertisement from the lifetime (led has not yet expired, the mobile mode has proviously attempt to disrover a new againt with which the register.  2.4.2.2. Algorithm 2  The second method uses network prefixes. The Prefix-Lengths whether or not a newly received Agent Advertisement was received on the same manner as the mobile mode sourcer care of address, the mobile mode SIDULD Attempt to disrover a new againt with which to register. Less and the same manner as the mobile mode sourcer care of address, the mobile mode signal, more such as the mobile mode sourcer care of address, the mobile mode signal, more such as the mobile mode signal, more such as the mobile mode signal, more asset mobile mode signal, which the current care of address. It signal, more than re-registering with its current care of address. It signal, which the mobile mode signal sending the more asset mobile mode signal, which its current care states an	
Мау	12.55 H 12.55	

Page 24							
	October 1996	to its home network ts own home agent. If Section 3). Before LD configure its rk (Section 4.2.1). In I, the mobile node MUST with regard to ARP,	of the sequence number gent with which it is he first and inside the ragain. If the second an or equal to 256, the mber has rolled over gistration is not	hanism for mobile nodes rmation to their home a foreign pattents	are-of address, e, and/or	ween a mobile node, tt. Registration Tome agent, associating address for the	Page 24
rfc2002.txt	IP Mobility Support	A mobile node can detect that it has returned to its home netwo when it receives an Agent Advertisement from its own home agent so, it SHOULD detegister with its home agent (Section 3). Befattempting to deregister, the mobile node SHOULD configure its rotuling table appropriately for its home network (Section 4.2.) addition, if the home network is using ARP [16], the mobile not follow the procedures described in Section 4.6 with regard to Proxy ARP, and gratuitous ARP.	If a mobile node detects two successive values of the sequence number in the Agent Advertisements from the foreign agent with which it is registered, the second of which is less than the first and inside the range 0 to 255, the mobile node SHOULD register again. If the second wolke is less than the first but is greater than or equal to 256, the mobile node swould are second mobile node shoulD assume that the sequence number has rolled over past its maximum value (Oxffff), and that reregistration is not necessary (Section 2.3).	Registration  Mobile IP registration provides a flexible mechanism for mobile to communicate their current reachability information to their happent. It is the method by which mobile nodes:  - request forwarding services when visiting a foreign natural.	inform their home agent of their current care-of renew a registration which is due to expire, and/deregister when they return home.	Registration messages exchange information between a mobile node (optionally) a foreign agent, and the home agent. Registration creates or modifies a mobility binding at the home agent, associate mode's home address with its care-of address for the specified Lifetime.	Standards Track
May 13 1998 10:38:26	RFC 2002	2.4	2.	ë.	1 1		Perkins
Ma	1291 1292 1293	1295 1296 1296 1298 1299 1300 1301 1304	1306 1307 1308 1310 1311 1313 1314 1315	1318 1318 1319 1320 1321 1322 1323	1324 1325 1326 1327 1328 1329	1332 1333 1333 1334 1336 1339 1339 1340 1341 1343 1343	1346 1346

May 13 1998 10:38:26 rfc2002.txt	1404 RFC 2002 IP Mobility Support October 1996 1405 1406 1406 1406 1406 1406 1406 1406 1406		1414 When the mobile node instead registers directly with its home agent, 1415 the registration procedure requires only the following two messages: 1416 a) The mobile node sends a Registration Request to the home 1418 agent.	1420 b) The home agent sends a Registration Reply to the mobile 1421 node, granting or denying the Request. 1422 The registration messages defined in Sections 3.3 and 3.4 use the 1424 User Datagram Protocol (UDP) (17). A nonzero UDP checksum SHOULD be 1425 included in the header, and MUST be checked by the recipient. 1427 3.2. Authentication		1440 3.3. Registration Request 1441 A mobile node registers with its home agent using a Registration 1442 Request message so that its home agent can create or modify a 1444 mobility binding for that mobile node (e.g., with a new lifetime). 145 The Request may be relayed to the home agent by the foreign agent 146 through which the mobile node is registering, or it may be sent 147 directly to the home agent in the case in which the mobile node is 148 registering a co-located care-of address.	IP fields: Source Address Typical message is se	İ
Page 25		<u></u>						
May 13 1998 10:38:26 rfc2002.txt P	PFT 2002 (October 1996) Support October 1996 Several other (optional) capabilities are available through the	ich enable a mob Itaneous registr unneled to each re-of addresses	mobility bindings, and discover the address of a home agent if the mobile node is not configured with this information.	Mobile IP defines two different registration procedures, one via a foreign agent that relays the registration to the mobile node's home agent, and one directly with the mobile node's home agent. The following rules determine which of these two registration procedures to use in any particular circumstance:  If a mobile node is registering a foreign agent care-of address, the mobile node MUST register via that foreign agent.	If a mobile node is using a co-located care-of address, and revives an Agant Advortisement from a foreign agent on the link on which it is using this care-of address, the mobile node SHOWLD register via that foreign agent (or via another foreign agent on this link) if the 'R' bit is set in the received Agent Advertisement message.  If a mobile node is otherwise using a co-located care-of address, the mobile node MUST register directly with its home agent.	(delegistering with its home agent, the mobile no register directly with its home agent, the mobile no register directly with its home agent.  The registration procedures involve the exchange of Figurest and Registration Reply messages (Sections 3.3 gistering via a foreign agent, the registration proceduring via a foreign agent, the registration proceduring four messages:  a) The mobbile node sends a Registration Request t	<u></u> –	

Page 26

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1 age 21													-								
	October 1996	gn agent or the					shown below:		2 3 4 5 6 7 8 9 0 1	e +++-+-+-+-+-+	- + + + + + + + + + + + + + + + + + + +		+ + + + + + + + + + + + + + + + + + + +	+	+ + + + + + + + + + + + + + + + + + + +		is set, the mobile retain its prior tion 3.6.1.2.	set, the mobile at to it any the home network,	node. If the 'D' bit is set, the decapsulate datagrams which are sess. That is, the mobile node is of address.	[Page 27]	
	IP Mobility Support	Destination Address Typically that of the foreign agent or the home agent.	See Sections 3.6.1.1 and 3.7.2.2 for details.		variable	434	The UDP header is followed by the Mobile IP fields shown below:	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	1	1.74.e   5  5  14  6  V  1.58V    1.1 ferime	Home Address	Home Agent	Care-of Address	Identification		l (Registration Request)	Simultaneous bindings. If the 'S' bit is set, the mobile node is requesting that the home agent retain its prior mobility bindings, as described in Section 3.6.1.2.	Broadcast datayrams. If the 'B' bit is set, the mobile node requests that the home agent tunnel to it any broadcast datagrams that it receives on the home network as described in Section 4.3.	Docapsulation by mobile node. If the 'mobile node will itself decapsulate dat. sent to the care-of address. That is, using a co-located care-of address.	Standards Track	
		ination Address home agent.	Jons 3.6.1.1 an	lds:	Source Port v	Destination Port 4	header is follo	0	1	dulaleletetetet	+++++++++++++++		+		Extensions	l (Registrat	Simultaneous node is requ mobility bir	Broadcast datagrams. node requests that t broadcast datagrams as described in Sect	Decapsulation mobile node sent to the using a co-h		
	RFC 2002			UDP fields:		Desti	The Upp	- - - - -		K1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1					Extens	Type	w	æ	۵	Perkins	
	1450 1450	146.2 146.4 146.4 16.4	1466	1469	17.3	1472	14.74	1476	87.71	1480	1487	148	1485	1487	1490 1491 1492	1494	1496 1497 1498	1501 1502 1503 1503	1505 1506 1507 1508 1509 1510	1512 1513 1514	

May 1	13 1998 1	1998 10:38:26 rfc2002.txt	Page 28
	RFC 2002	1P Mobility Support October 1996	96
1519 1520 1521 1522	Σ	Minimal encapsulation. If the 'M' bit is set, the mobile node requests that its home agent use minimal encapsulation [15] for datagrams tunneled to the mobile node.	
1524 1525 1525 1527 1527	၁	GRE encapsulation. If the 'G' bit is set, the mobile node requests that its home agent use GRE encapsulation [8] for datagrams tunneled to the mobile node.	
1528 1530 1531 1531	>	The mobile node requests that its mobility agent use Van Jacobson header compression [10] over its link with the mobile node.	-
1533	rsv	Reserved bits; sent as zero	
1534 1535 1537 1538 1539	Lifetime	time  The number of seconds remaining before the registration is considered expired. A value of zero indicates a request for deregistration. A value of Oxffff indicates infinity.	v.
1541	Home 1	Home Address The IP address of the mobile node.	
1544	Home A	. Agent The IP address of the mobile node's home agent.	
1547	Care-of	e Address The IP address for the end of the tunnel.	
1550 1551 1553 1553 1553	Identi	Identification A 64-bit number, constructed by the mobile node, used for matching Registration Requests with Registration Replies, and for protecting against replay attacks of registration messages. See Sections 5.4 and 5.6.	or on
1555 1556 1558 1559 1560 1561 1561 1562 1563	Extens	Extensions  The fixed portion of the Registration Request is followed by one or more of the Extensions Listed in Section 3.5.  The Nobile-Home Authentication Extension MUST be included in all Registration Requests. See Sections 3.6.1.3 and 3.7.2.2 for information on the relative order in which different extensions, when present, MUST be placed in a Registration Request message.	3ed 1
	Perkins	Standards Track   Page	28]

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13 1998	May 13 1998 10:38:26	rfc2002.txt	Page 29
PEC 2002	:	IP Mobility Support Oct	October 1996
1.4. R	5.4. Registration Repty		
A muck	doility agent return which has sent a B mobile node is requ	A mubility augent returns a Registration Reply message to a mobile much which has sont a Reqistration Request (Section 3.3) message. If the mobile note is requesting service from a foreign agent, that foreign admits the Dealy from the home contents.	obile sage. Ir that
Sub Che Pequ	subsequently relay it to the mobile of the necessary codes to inform the mob Request. A along with the lifetime gran be smaller than the original Request.	to the mobile node. The Reply message inform the mobile node about the state inform the mobile node about the state of informer granted by the home agent, iginal Request.	contains us of its which MAY
The good of the graph of the gr	i foreign agent MUST olde node in the Regil near by the Mobile-H reactly (re) computed transus the Lifetime subset; since doing so distration Lifetime a listration the Registriated in the Registriation received it that the lifetime received is the lifetime received.	The foreign agent NUST NOT increase the Lifetime selected by the wobile node in the Registration Request, Since the Lifetime is covered by the Mobile-Home Authentication Extension, which cannot be currectly (re) computed by the foreign agent. The home agent NUST NOT increase the Lifetime selected by the mobile node in the Registration Request, Since doing so could increase it beyond the maximum Registration Lifetime allowed by the foreign agent. If the Lifetime received in the Registration Reply is greater than that in the Registration Request, the Lifetime in the Reguest MUST be used, When the Lifetime in the Reguest MUST be used.	the is annot be MUST NOT istration Lifetime he ed When
the	the Registration Reques IP tields:	it, the Lifetime in the Reply MUST be u	ısed.
	Source Address	Typically copied from the destination address of the Registration Request to which the agent is replying. See Sections 3.7.2.3 and 3.8.3.1 for complete details.	on to which s 3.7.2.3
	Destination Address	Copied from the source address of the Registration Request to which the agent replying	ne yent is
UDF	UDP fields:		
	Source Port	<variable></variable>	
	Destination Port	Copied from the source port of the corresponding Registration Request (Section 3.7.1).	
Perkins	tc	Standards Track	(Page 29)

1522   Per 2002   1P Hobility Support   Octobor 1996   1620   1	May	13	1998 10	10:38:26	rfc.	rfc2002.txt	Page	e 30
The UDP header is followed by the Hobile IP fields shown below:  0 12345678901234567890  1 2345678901234567890123456789012345678901  Type   Code   Lifetime   Lifetime   Lime Address   Lifetime   Lime Address   Lifetime   Lifetime   Lime Address   Lifetime   Lifeti	1627 1628 1629		2002		IP Mobility		1996	
Type   Code   Lifetime   Lifetime   Code	1631		he UDP h	eader is f	ollowed by the M			
Type Code   Lifetine	1633		1 2	5 6 7	1 0 1 2 3 4 5 6	2 8 9 0 1 2 3 4 5 6 7 8 9	_	
Home Address   Home Address   Home Address   Home Address   Home Address   Home Address   Home Agent   Home Agent   Home Agent   Home Agent   Home Agent   Home Address   Home Agent   Home Address   Home Agent   Home Address   Hom	1636		+ = +	† — ·	-+-+-+-+-+-+-+-+-+-+-+-+-+-+-++		<u>:</u> -	
Identification    Identification   Ident	1638				+ ·	+++++++++++++++++++++++++++++++++++++++	<del>-</del>	
Identification  Extensions  Type 3 (Registration Reply)  Code A value indicating the result of the Registration Request. See below for a list of currently defined cyalues.  Lifetime T the Code field indicates that the registration was accepted, the lifetime field is set to the number of seconds remaining before the registration is consider expired. A value of Caro indicates that the mobile of seconds remaining before the registration was accepted, the Code field indicates that the mobile of seconds remaining before the registration was denied, the contents of the Lifetime registration was denied, the contents of the Lifetime field are unspecified and MUST be ignored on reception Home Address  The 1P address of the mobile node.  Home Ayent  The 1P address of the mobile node's home agent.  The 1P address of the mobile inde's home agent.	1640	-+	. :	+	Home Ag	+ + + + + + + + + + + + + + + + + + + +	<del>-</del>	
Extensions  Type 3 (Registration Reply)  Code A value indicating the result of the Registration Request. See below for a list of currently defined Cyalues.  Lifetime  Lifetime  If the Code field indicates that the registration was accepted, the Lifetime field is set to the number of seconds remaining before the registration is consider expired. A value of Caro indicates that the mobile of seconds remaining before the registration is consider expected. A value of Oxfff indicates that the registration was denied, the contents of the Lifetime field are unspecified and MUST be ignored on reception Home Address  The 1P address of the mobile node.  Home Ayent  The 1P address of the mobile inder's home agent.	1642	-+			Tdontifica	+ + + + + + + + + + + + + + + + + + + +	<del>,</del> –	
Extensions	1644		+-+-+-	+	-+-+-+-	1	+	
Code A value indicating the result of the Registration Request. See below for a list of currently defined covalues.  Lifetime	1646	_+	Extensi	: ‡				
Code A value indicating the result of the Registration values.  Lifetime  Lifetime  Lifetime  Lifetime  The Code Eield indicates that the registration was accepted, the Lifetime field is set to the number of seconds remaining before the registration is consider sequenting before the registration is consider sequenting before the registration is consider sequentially. If the Code field indicates that the has been deregistered. A value of Oxffff indicates infinity. If the Code field indicates that the registration was denied, the contents of the Lifetime field are unspecified and MUST be ignored on reception Home Address  The IP address of the mobile node.  Home Agent  The IP address of the mobile inde's home agent.	1649		Туре		stration Reply)			
Lifetime  If the Code field indicates that the registration was accopted, the Lifetime field is set to the number of seconds remaining before the registration is consider expired. A value of zero indicates that the mobile number of oxeff indicates infinity. If the Code field indicates that the registration was denied, the contents of the Lifetime field are unspecified and NUST be ignored on reception Home Address  The IP address of the mobile node.  Home Agent  The IP address of the mobile node's home agent:  The IP address of the mobile node's home agent:	1651 1652 1653		Code	A value Request values.	indicating the r . See below for	٠	Code	
If the Code field indicates that the registration was accepted, the Lifetime field is set to the number of seconds remaining before the registration is consider expired. A value of zero indicates that the mobile number of a value of of Oxfff indicates infinity. If the Code field indicates that the registration was denied, the contents of the Lifetime field are unspecified and MUST be ignored on reception.  Home Address The IP address of the mobile node.  Home Agent The IP address of the mobile node's home agent.	1654		Lifeti					
Home Address of the mobile node.  Home Agent The 1P address of the mobile node's home agent.  Standards Track (Page	1656 1657 1659 1660 1661 1663			If the accepte seconds expired has bee infinity registrictield a	Code field indica d, the Lifetime f remaining before A value of zer n deregistered. Y If the Code f Ation was denied, re unspecified an	ield is set to the number of the registration we is the registration is consider of indicates that the mobile A value of Oxffff indicates itled indicates that the contents of the Lifetind MUST be ignored on recepting	as F Fared node no	
Home Agent The 1P address of the mobile node's home agout.  Standards Track (Page	1665			ddress The 1P	address of the mo	bile node.		
Perkins Standards Track (Page	1668 1669 1670		Home Aç	Jent The IP	address of the mo	bile node's home agent.		
Perkins Standards Track (Page	1671 1673 1674 1675 1676 1677 1677 1678 1679							
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Σ	1739	1742 1743 1744 1746 1746 1747 1748 1750 1751	1754 1755 1756 1757 1758 1759 1760 1760	1762 1763 1764 1765 1765 1766	1768	1772 1772 1773 1775 1776 1776 1777 1779 1789 1781 1781	1787 1787 1789 1790 1791 1793 1793 1793	
	T							
Page 31							·	
	October 1996	tration Requests cuting against . The value is the Registration d on the style of context between ined by the ined by the time by the time by the time by the time by the time by the	pply is followed in Section 3.5. i MUST be included the home agent.	Code field.		lable sived) eceived) received)	[Page 31]	
rfc2002.txt	IP Hobility Support	A 64-bit number used for matching Registration Requests with Registration Replies, and for protecting against replay attacks of registration messages. The value is based on the Idontification field from the Registration Request message from the mobile node, and on the style replay protection used in the security context between the mobile node and its home agent (defined by the wold) is not a sociation between them, and SPI value in the Mobile-Home Authentication Extension). See Sections 5.4 and 5.6.	The fixed portion of the Registration Reply is followed by one or more of the Extensions listed in Section 3.5. The Mobile-Indome Authentication Extension MUST be included in all Registration Replies returned by the home agent. See Sections 3.7.2.2 and 3.8.3.3 for rules on placement of extensions to Reply messages.	The following values are defined for use within the Code field.  Registration successful:  0 registration accepted   registration accepted     registration accepted     registration accepted     registration accepted	Franklin denied by the foreign agent:	e unava or recc error i error i	Standards Track	
May 13 1998 10:38:26	RFC 2002	Identification A 64-1 A 64-1 A 10-1 A	Extensions The Fi by one The Mc The Mc In a II See Se	The following values are def Registration sucressful: 0 registration accepted 1 registration accepted	Registration denied by the	64 reason unspecified 65 administratively prob 66 insufficient resonres 67 mobile node failed au 68 home agent failed au 69 requested hifetime too 70 poorly formed Request 71 provly formed Reply 72 requested encapsulati 74 requested encapsulati 74 requested encapsulati 74 requested on Jacobson 80 home network unreachab 81 home agent host unreach 82 home agent port unreach 83 home agent prort unreach 84 home agent unreachab	Perkins	
May	1583 1684 1685 1685	1688 1688 1689 1691 1693 1694 1696	1698 1700 1701 1701 1703 1704 1705	1707 1708 1709 1710 1711	1713	1716 1717 1717 1718 1720 1721 1722 1724 1724 1729 1726 1727 1728		

May	13 1998	10:38:26 <b>rtc2</b>	IICZOUZ.IXI		Page 32
1739	RFC 2002	1P Mobility Su	Support	October 1996	
1742	Registrati	Registration denied by the home agent	::		
1745	128	reason unspecified			
1746	129	administratively prohibited insufficient resources			
1748	131	mobile node failed authentication	ion		
1749	132	foreign agent failed authentication	ation		
1751	134	registration mentilication mi poorly formed Request	smarch		
1752	135	too many simultaneous mobility binding unknown home agent address	bindings .		
1754	Up-to-date	values of the Code	field are specified in the m	most recent	
1757 1758	3 S Registra	Derrictration Services			
759					
1760	3.5.1. Comput	3.5.1. Computing Authentication Extension Values	n Values		
1762	The Authenticator MUST protect the	value computed following fields	or each authentication Extensi from the registration message:	xtension ssage:	
1765	- the UDP Registra	payload (that is, ition Reply data),	the Registration Request or		
1768	- all pr	all prior Extensions in their ent	entirety, and		
0771	- the Ty	Type and Length of this Extension	sion.		
1772 1773 1774 1775	The defaul prefix+su registrati	The default authentication algorithm uses keyed-MD5 [21] in "prefix+suffix" mode to compute a 128-bit "message digest" of registration message. The default authenticator is a 128-bit computed as the MD5 checksum over the the following stream of	uses keyed-ND5 (21) in -bit "message digest" of thenticator is a 128-bi the following stream of	n of the bit value of bytes:	
1777	- the sha hetweer authen	the shared secret defined by the mobility security association between the nodes and by SPI value specified in the authentication Extension, followed by	mobility security ass e specified in the d by	ociation	
1781	- the pro	the protected fields from the registration message, specified above, followed by	istration message, in	in the order	
1784	- the sh	the shared secret again.			
1786 1787 1788 1789 1790 1791	Note that tincluded in Section 5.1 authenticat authenticat	Note that the Authenticator field itself and the UDP header included in the computation of the default Authenticator val Section 5.1 for information about support requirements for mauthentication codes, which are to be used with the various authentication Extensions.	field itself and the UDP header are HO of the default Authenticator value. S about support requirements for message are to be used with the various	r are NOT nlue. See message	
792 793 794	Perkins	Standards Track	<u>ي</u>		
				lvc añe	

The Security Parameter Extensions defines the Authoriteans value an that value. In particulation of porticulation than and mode (Security operator) that and mode (Security pariato public/prix Authoriteator. In ordainplementations of the able to associate any serve which it implement the cand mode (Porefix-suffix 18.5.2. Hobile-Home Authorite Exactly one Hobile-Home Authorite Propile-Home	The Security Parameter Index (SPI) within any of the authentication Extrusions defines the security context which is used to compute the factor value and which HUST be used by the receiver to check that value. In particular, the SPI selects the authentication digitized in and mode Gection 5.1) and secret a shared key, or appropriate public/private key pair) used in computing the which retained product Gection 5.1) and secret a shared key, or appropriate public/private key pair) used in computing the definest to ensure interoperability between different implementations of the Hubile IP protocol, an implementation MUST be made which it implements. In addition, all implementations of Mobile IP HUST implement the default authentication algorithm (keyed-MD5) and lands I prefix suffix.) defined above.  5.5.2. Hobile-Home Authentication Extension August be present in all Registration Requests and Registration Replies, and is intended to eliminate problems [2] which result from the uncontrolled propagation of remote redirects in the Internet. The location of the extension marks the end of the authenticated date.  1.2. 3.4.5.6.7.8.9.0.1.2.3.4.5.6.7.8.9.0.1.2.3.4.5.7.8.9.0.1	October 1996 entication compute the r to check arion . or en different ion MUST be algorithm and algorithm and lgorithm and s intended eyed-MD5) resent in s intended ation of the 13 3 9 0 1
sions defines the an calue an in particular value an calue, in particulting and mode (see a see	Index (SPI) within any of the authentic security context which is used to compare which which is used to compare their their security context which is used to compare their their security the security security is a shared key, or vate key pair) used in computing the set to ensure interoporability between dest to ensure interoporability between the solid security and any authentication algorithm (keysel value with any authentication algorithm (keysel value security) defined above.  It an addiction, all implementations of a and default authentication algorithm (keysel ix.) defined above.  C. Authentication Extension NUST be pressed and security from the uncontrolled redirects in the Internet. The location of the authenticated data.	teation bute the check bu f f f f f f f f f f f f f f f f f f
lobile-Home Authent 1y one Hobile-Home oggistration Reques iminate problems I gation of remote a	ktension bon Replies rom the unsternet.  2 2 3 4	sent in trended on of the 3 0 1
usion marks the end	1234567890123456789	0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5	Length   SPI	
Type 32 Length 4 pl	32 4 plus the number of bytes in the Authenticator	Cator
SP1 Secu iden	Security Parameter Index (4 bytes). An opaque identifier (see Section 1.6).	edne
Authenticator (var	(variable Length) (See Section 3.5.1.)	
Mobile-Foreign Auth Extension MAY be i ases in which a mob le node and the for t support requirement	3.5.3. Mobile-Foreign Authentication Extension This Extension MAY be included in Registration Requests and Replies in cases in which a mobility security association exists between the mobile node and the foreign agent. See Section 5.1 for information about support requirements for message authentication codes.	eplies een the metion
Perkins	Standards Track	Page 33

May	/ 13 1998 10:38:26	rfc2002.txt	Page 34
1851 1852 1853	RFC 2002	IP Mobility Support October 1996	1
1855 1856 1857 1858 1859 1860	4 5 -+-+ e -+-+	6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1	
1861 1862 1863	Туре	Ť	
1864 1865 1866	Length	4 plus the number of bytes in the Authenticator.	
1867 1868 1869	IdS	Security Parameter Index (4 bytes). An opaque identifier (see Section 1.6).	
1870 1871 1872	Authenticator 3.5.4. Foreign-Home	Authenticator (variable length) (See Section 3.5.1.)	
1874 1874 1876 1876 1877	This Extension MA in cases in which foreign agent and about support req	This Extension NAV be included in Registration Requests and Replics in cases in which a mobility security association exists between the foreign agent and the home agent. See Section 5.1 for information about support requirements for message authentication codes.	
1879 1880 1881 1882 1883 1884	0 1 2 3 4 5 6 7 8 9 0 1 1 2 3 4 5 6 7 8 9 0 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1	
1887	Type	34	
1889	Length	4 plus the number of bytes in the Authenticator.	-
1891 1892 1893	IdS	Security Parameter Index (4 bytes). An opaque identifier (see Section 1.6).	
1894 1895 1896	Authenticator (variable 3.6. Mobile Node Considerations	(variable length) (See Section 3.5.1.)	-
1897 1898 1899 1900 1901 1902	A mobile node HUST and a mobility sec addition, a mobile or more of its hom home agent using t	A mobile node HUST be configured with its home address, a netmask, and a mobility security association for each home agent. In addition, a mobile node MAY be configured with the IP address of one or more of its home agents: otherwise, the mobile node MAY discuver home agent using the procedures described in Section 3.6.1.2.	. e
1904 1905 1906	Perkius	Standards Track (Page 34	
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May 13 1998 10:38:26	1963 1964 RFC 2002 1965 1966 1967 3.6.1. Sending Registration	1968 1970 1970 1970 1971 1971 1972 1973 1973 1973 1973 1974 1974 1975 1976 1977 1976 1977 1978 1978 1978 1978 1978 1978 1979 1978 1979 1979	
Page 35			
	October 1996 maintains the	to which the e. nn ration.  tration.  tration.  tration.  tration.  tration.  tration.  Amen it is away  on. When it is away  or it. When it is at  set allows its home  set allows its home  functions when it is at  lie node SHOULD  hen the mobile node  s specified in Section  etime is near  ts specified in Section  etime is near  ts spould NOT cause a  tts current  ts stouch of  ts stouch of  ts stouch of  ts stouch of  ts stouch of  ts currently  cations, a mobile node  it is currently  cations, a mobile node  then transport-  onte per second.  and then transport-  the mobile node MAY	
rfc2002.txt	2002.  Por earth pending registration, the mobile node maintains the tollowing intormation:	Projection to be detected as sent. If applicable, the Benjairation bequest was sent. If applicable, the Hoteland address of the Registration Request. The Defection address of the Registration Request.  The Defection and address of the Registration Request. The Defection and the sent in the registration.  The Defection and the sent in the registration.  The project of address used in the registration.  The project of address used in the registration.  The project of the pending registration wherever it detects a choice in the section of the pending registration.  A mediate unite that make such a determination. When it is away affect which mobile under NAY make such a determination. When it is an element in a network connectivity. See Section 2.4.3 for invention to the name of the project of the section of the pending to the whom it is at home. The mobile node's Registration Request allows its home against to delete any previous mobility binding for it. When it is at home. The foreign agent has rebooted (as specified in Section element. Angel and its forsign agent when the mobile node detects that the foreign agent has rebooted (as specified in Section addition.) and when the nobile node detects that Advertisaments from new agents SHOULD MOT cause a mobile node the rest that the foreign agent has rebooted (as specified in Section and it not expired and it is still also receiving Agent Advertisaments from the foreign agent with which it is currently the contraints of the section and it is still also receiving Agent to register with a different agent when transport-dayer indications, a mobile node MNT register with a different agent when transport that is currently providing service to it as reason to register with register adain at any time.  Appendix of consider reception of an ICMP Redicert from a foreign agent with a may time.  Appendix of register with a different agent when transporting it is currently browing some examples of how the fields in registration measures.	
May 13 1998 10:38:26	1907 1908 per 2002 1909 1911 Por each pending regis 1912 tollowing intormation:	Te di	

Page 36												
xt	October 1996		the values the mobile node equest messayes.	rules by which mobile nodes pick a Registration Request.		vith a co-located care-of the care-of address.	source address MUST be the		the agent with which it is inverted agent the IP address of the agent the TAN Mobility Agents" he used. In this case, the clayer unicast address in correct agent.	the address of the agent, the corresponding Agent, when transmitting obblie node NUST use a om the link-layer source age in which it learned	octly with its home of its home agent, the address.	(Page 36)
rfc2002.txt	IP Mobility Support	Sending Registration Requests	following sections specify details for the values the supply in the fields of Registration Request messages	section provides the specific rules by section provides the specific rules by stor the IP header fields of a Registr		When registering on a foreign network with address, the IP source address HUST be the	the IP	ress:	has discovered to some means (e.g. so of the agent of the node), then the agent of 0.0.11) MUST be agent's linh datagram to the	When registering with a foreign agent, the address of the agent as learned from the IP source address of the corresponding Agent Advertisement MUST be used. In addition, when transmitting this Registration Request measage, the mobile node MUST use a link-layer destination address copied from the link-layer source address of the Agent Advertisement message in which it learned this foreign agent's IP address.	When the mobile node is registering directly with its home agent and knows the (unicast) IP address of its home agent, destination address MUST be set to this address.	Standards Track
May 13 1998 10:38:26	RFC 2002	3.6.1. Sending Regist	The following sect MUST supply in the	This section provi	IP Source Address:	- When registerin address, the Il	- In all other circumstances, mobile node's home address.	IP Destination Address:	- When the mobile node registering, through provide the IP addres is unknown to the mod multicast address (2, mobile node MUST use order to deliver the	- When registering as learned from Advertisement Publishers Registration in hink-layer destaddress of the this foreign ag	<ul> <li>When the mobile agent and knows destination add</li> </ul>	Per kins

13 1998 10:38:26  If the mobile node is registering directly with its home agent, to automatically determine the IP address of its home agent, to automatically determine the IP address of its home agent, to automatically determine the IP address of its home agent, to automatically determine the IP address of the mobile node; to automatically determine the IP address of the mobile node; to automatically determine the IP address of the mobile node; set to its summer directly for the summer directly for the mobile node; set to its summer directly for the summer directly for the summer directly for the summer directly for the summer directly mobile node; set to the summer directly for the summer directly agent.  The IP TTM, field MUST be set to 1 if the IP dustination address described above.  The IP TTM is to Live:  The IP TTM is address with standard IP practice [19].  This section provides specific rules by which mobile nodes pick values for the fields within the fixed portion of a Registration  A mobile node MMX set the 'S' bit in order to request that the home agent mannation previous binding(s) or replaces the within the new mobile node sing are likely to be useful when a mobile node using at least or with standard IP practice (19).  A mobile node MMX set the 'S' bit in order to request that the home agent mobile node MMX set the 'S' bit in order to request that the home agent least or with standard in the Registration Request. Multiple simultaneous mobility binding(s) and replaces within wireless in mubility bindings are likely to be useful when a mobile node using are likely to be useful when amobile node will lower duplication of datagrams destinance copy of each simultaneous bindings, it will turned a separate copy of each simultaneous bindings. It will turned a separate copy of each simultaneous bindings, it will turned a separate or but mobile node MMX set the 'B' bit to request its home accepted by the mobile node, as determined by the mobile node, as determined by the mobile node, as determined by the

1277 FFC 2002 IP Mobility Support October 1996 2027 2028 2028 2029 2029 2020 2020 2020 2020				
ref the 'D' bit is set, then the mobil will decapsulate any datagrams tunnel is tisel (the mobile node, the home agent MUST address. The mobile node de-tunnels same way as any other datagram tunnel same way as any other datagram tunnel same way as any other datagram tunnel fire in using a foreign agent care foreign agent will thus decapsulate forwarding them to the mobile node. WINST first encapsulate the broaderses of a mobile node agent the independences unicast IP datagram addressed to the mobile node agent the independences unicast IP datagram addressed to the mobile node in the same way as any tunnel thus be a unicast IP datagram addressed identifying to the foreign agent the incapsulated broadcast datagram and MUST first encapsulated broadcast datagram and HUB will be a unicast IP datagram addressed identifying to the foreign agent the incapsulated broadcast datagram and MUST decapsulate broadcast datagram and MUST decapsulate broadcast datagram and MUST decapsulate broadcast datagram into the mobile node in the same way as any tunnel mobile node and vergest alternative first mobile node MUST wor set the 'B' bit in its Roseu unless it is capable of decapsulation bits in the Mobility Agent Advertisement hadvertisement received by the mobile node MUST NOT set these bits.  The Lifetime field is chosen as follows:  - If the mobile node is registering with Lifetime SHOULD NOT exceed the value field of the Agent Advertisement hadvertisement Lifetime (1800 seconds) Advertisement Lifetime (1800 seconds)  Perkins  Standards Track  - Advertisement Lifetime (1800 seconds)	October 1996 as indicated that it its care-of address. I care-of address. udcast detagram to tt to this care-of tt to this care-of tty to it. tty to it.	datagrams before case, to forward bile node, the home tragram in a unicast address, and then bile node's care-of ner datagram will mobile node, destination of the tagram arriving for sea a local network The mobile node thus tagram itself, and ion Request in this agrams.	if the mobile node de is using a code de is using a code has indicated on for the corresponding nof an Agent wise, the mobile ium agent, the gedistration Lifetime ived from the care-of address is lit ICMP Router	[ Page 38]
A Per la company de la company	bit is set, then the mobile node losulate any datagrams tunneled to the mobile node is using a co-located is node, the home agent WIGT tunnel. The mobile node de-tunnels the receis any other datagram tunneled directly bit is NOT set, then the mobile not using a foreign agent care-of addatagram tunneled directly bit is NOT set, then the mobile not using a foreign agent care-of addatagrams.	them to the mobile node. In this them to the mobile node. In this first encapsulate the broadcast detegram to the mobile node. In this first encapsulate the broadcast dedeessed to the mobile node's home. It his resulting datagram to the moticast IP datagram addressed to the moticast IP datagram addressed to the to the foreign agent the intended of broadcast datagram, and will be din the same way as any tunneled da node. The foreign agent MUST NOT do broadcast datagram, and MUST NOT of the doroadcast datagram and MUST NOT of the cansmit it to the mobile node. Unate the encapsulated broadcast datagram and encapsulated broadcast datagram and such the solution of transmit it to the mobile node. Unate the encapsulated broadcast datagram and it is capable of decapsulating datagram.	e hard reguest atternative forms of but and/or the 'G' bit, but only no its own datagrams (the mobile no fadders) or if its foreign agent adderso, or if its foreign agent see forms of encapsulation by settibility Agent Advertisement Extension received by the mobile node. Other set these bits.  Ile node is registering with a fore 100LD NOT exceed the value in the Recould not include a Lifetime, the defaint Lifetime (1800 seconds) MAY be not include a Lifetime of the control of	Standards Track
2075 2076 2077 2078 2080 2081 2081 2081 2081 2081 2081 208	RFC 200	foreign ag forwarding such a rec agent MUST datagram a MUST tunne address. When decaps thus be a un identifying encapsulate mobile node the mobile node the mobile served broadcast the MUST decaps thus MUST decaps	setting the 'Massetting the 'Massetting the 'Massette' care to support for the bits in the Mot Advertisement and but Must Must Must Must Must Must Must Mu	Perkins
	2075 2077 2077 2077 2080 2081 2083 2088 2088 2088 2088	2089 2099 2099 2093 2093 2093 2096 2098 2098 2098 2103 2103 2104 2104 2104 2105 2105 2105 2105 2105 2105 2105 2105	2111 21111 21111 21114 21115 21117 21120 2120 21212 2122 2123 2123 2123 21	

Page 38

rfc2002.txt

May 13 1998 10:38:26 rfc2002.txt	2187 2188 RFC 2002 IP Mobility Support	2190 2191 2191 2192 2193 2193 2193 2194 2194 2194 2194 2194 2194 2194 2194	9.	. –	3.6	2216 In addition, the low-order 32 bits of the Identif 2217 Registration Reply MUST be compared to the low-or 2218 Identification field in the most recent Registrat 2219 the replying agent. If they do not match, the Re 2220 discarded.	2222 Also, the authentication in the Registration Repl 2223 That is, the mobile node MUST check for the prese 2224 authentication Extension, acting in accordance wi 2225 the Reply. The rules are as follows:	22.2 a) If the mobile node and the foreign agent 22.2 mobility security association, exactly on 22.2 Authentication Extension MUST be present 22.2 Reply, and the mobile node MUST check the 22.31 value in the Extension. If no Mobile-For	2232 Extension is found, or if more than one M 2233 Authentication Extension is found, or if 12234 invalid, the mobile node MUST silently di 2235 SHOULD log the event as a security except 2237 2237	2240 2241 2242 Perkins Standards Track	· .
				<del> </del>	<del>-</del>						<del></del>
Page 39				7 t.				<del></del>	~		
	October 1996	a particular equest with the etime field set to	the mobile node's Otherwise, the colution to learn mobile node MUST	acciving such a address MUST reject rejection serior reject rejection is for use by the	of the particular Predister. In the gister all care-of ess.	me agent. This is le node shares with which the mobile	mandatory and any optional Registration Reguest.	followed by the equest, followed by ons expected to be ot also be used by	followed by ons used only by	[Page 39]	
rfc2002.txt	IP Mobility Support	sk a home agent to delete a particular sending a Registration Request with the his binding, with the Lifetime field set of zero is used when the mobile node	be set to the address of the mobile mode mode knows this address. Otherwise, the ic home agent address resolution to learn gont. In this case, the mobile mode WUST for the submartainers of the mobile mode WUST.	twork. Each home agent is a broadcast destination ation and SHOULD return a ling its unicast IP addressistration attempt.	MUST be set to the value of the particula MUST be set to delregister. In the phile node wishes to deregister all carcols field to its home address.	ttion it uses with its he tity association the mobi ion 5.6 for the method by ication field.	e ordering of any mandatory and any opt ode appends to a Registration Request. UST be followed:	The IP header, followed by the UDP header, followed by the fixed-length portion of the Registration Request, followed by If present, any non-authentication Extensions expected to be used by the home agent (which may or may not also be used by the foreign anont) followed has a probable.	The Mobile-Home Authentication Extension, followed by If present, any non-authentication Extensions used only by the foreign agent, followed by	Standards Track	
May 13 1998 10:38:26	2002	- The mobile node MAY ask a mobility binding, by send care-of address for this zero (Section 3.8.2) Similarly, a Lifetime of	deregisters all care-of addresses, such as upon returning home. The Home Agent field MUST be set to the address of the mobile node's home agent, if the mobile node knows this address. Otherwise, the mobile node MAY use dynamic home agent address resolution to learn the address of its home agent. In this case, the mobile node MUST set the Home Agent is the chance all and the submoth.	the mobile node's home ne Registration Request with the mobile node's registra Registration Reply indical mobile node in a future re	The mobile jude chooses the Identification field in accordance with	the Style of replay protection it uses with its home agent. This is part of the mobility security association the mobile node shares with its home agent. See Section 5.6 for the method by which the mobile node computes the Identification field.  6.1.3. Extensions	sec sio fol	a) The IP header, followed by the fixed-length portion of the Reg b) If present, any non-authenticat used by the home agent (which m the foreign agent) followed by	c) The Mobile-Home Authe d) If present, any non-a the foreign agent, fo	Perkins	
May 1	2131 2132 RFC 2133	2114 2115 2116 2118 2118 2118 2118 2118	2141 2142 2143 2144 2146 2146	2148 2149 2150 2151 2153 2154	2155 2155 2159 2159	<u> </u>	2167 2168 2168 2169 2170	2172 2173 2173 2174 2175	2177 2178 2179 2180 2181 2182 2183 2183		

2187	RFC 2002	IP Mobility Support	October 1996
2190	e) The M	The Mobile-Foreign Authentication Extension,	if present.
2193 2194 2195 2196	Note that ite sent by the m However, item foreign agent	Note that items (a) and (c) MUST appear in every Registration Request sent by the mobile node. Items (b), (d), and (e) are optional. However, item (e) MUST be included when the mobile node and the foreign agent share a mobility security association.	stration Request e optional. ode and the
2198	3.6.2. Receiving	3.6.2. Receiving Registration Replies	
2200	Registration Replies to its Registration F into three categories	will be received by the mobile tequests. Registration Replies:	node in response generally fall
204	- the regist - the regist - the regist	the registration was accepted, the registration was denied by the foreign agent, the registration was denied by the home agent.	. 01
208	The remainder handling by a	The remainder of this section describes the Registration Reply handling by a mobile node in each of these three categories.	ion Reply gories.
211	3.6.2.1. Validity Checks	y Checks	
213	Registration Replie silently discarded.	Registration Replies with an invalid, non-zero UDP checksum MUST silently discarded.	ecksum MUST be
216 217 218 2219 2220	In addition, Registration Identification the replying discarded.	In addition, the low-order 32 bits of the Identification field in the Registration Reply MUST be compared to the low-order 32 bits of the Identification field in the most recent Registration Request sent to the replying agent. If they do not match, the Reply MUST be silently discarded.	ion field in the 32 bits of the Request sent to MUST be silently
222 223 223 225 225	Also, the aut That is, the authentication the Reply. Til	Also, the authentication in the Registration Reply MUST be checked That is, the mobile node MUST check for the presence of a valid authentication Extension, acting in accordance with the Code field the Reply. The rules are as follows:	IST be checked. of a valid he Code field in
2222 2228 2228 2223 2233 2233 2234 2235	a) If the mobil and anther Reply value Extens Auther Auther invals SHOULL	If the mobile node and the foreign agent share a mobility security association, exactly one Mobile-Foreign Authentication Extension MUST be present in the Registration Keply, and the mobile node MUST check the Authenticator Extension. If no Mobile-Foreign Authentication Extension is found, or if more than one Mobile-Foreign Extension Extension is found, or if the Authentication Extension is found, or if the Authenticator in invalid, the mobile node MUST silently discard the Reply and SHOULD log the event as a security exception.	e a bile-Foreign henticator henticator Authentication e-Foreign Authenticator is d the Reply and
2237 2238 2239 2240			
2242	Perkins	Standards Track	[Page 40]
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Page 40

May 13 1998 10:38:26 rfc2002.txt	RFC 2002 IP Mobility Support	Request and Reply that started the timing of the mobile node and its home agent.		In this contain willing MAY act in the in the val	Coc	protecti adjust t field ba before i		3.6.3. Registration Retransmission When no Registration Reply has been received with time, another Registration Request MAY be transmi timestamps are used, a new registration Identific each retransmission; thus it counts as a new regin nonces are used, the unanswered Request is retran	Perkins Standards Track	
Ma	2299 2300 2301	2302 2304 2304 2306	2309 2309 2310 2311 2312	2313 2314 2315 2316 2316 2318 2319	2321 2322 2323 2324 2324 2325	2327 2327 2328 2329 2330	2332 2334 2334 2335 2336 2336 2339 2340 2341	2345 2346 2346 2346 2346 2350	2352 2353 2353 2354	
Γ	l	<del> </del>			-	······································				
Page 41										
May 13 1998 10:38:26 rfc2002.txt	RFT 2002 IP Mobility Support October 1996	b) If the Code field indicates that service is denied by the home agent, or if the Code field indicates that the registration was accepted by the home agent, exactly one Mobile-Home Authentication Extension MUST be present in the Registration Rebly, and the mobile node MIST chart he	Authenticator value in the Extension. If no Mobile-Home Authentication Extension is found, or if more than one Mobile-Home Authentication Extension is found, or if the Authenticator is invalid, the mobile node MUST silently discard the Reply and SHOULD log the event as a security	exception.  If the Code field indicates an authentication failure, either at the foreign agent or the home agent, then it is quite possible that any authenticators in the Registration Reply will also be in error. This could happen, for example, if the shared secret between the mobile node and home agent was erroneously configured. The mobile node such errors as security exceptions.	3.6.2.2. Registration Request Accepted If the Code field indicates that the request has been accepted, the mobile node SHOULD configure its routing table appropriately for its current point of attachement Georgian A 2 11	E . D	If the mobile node has registered on a foreign network, it SHOULD re-register before the expiration of the Lifetime of its registration. As described in Section 3.6, for each pending Registration Request, the mobile node MUST maintain the remaining lifetime of this pending registration, as well as the original Lifetime of this pending registration Request. When the mobile node MUST decrease its view of the remaining lifetime of the registration by the mobile node Lifetime. By which the home agent decreased the originally requested Lifetime. This procedure is equivalent to the mobile node starting a timer for the originally requested Lifetime.	even though the granted Lifetime is not known to the mobile node until the Registration Reply is received. Since the Registration Reply is received. Since the Registration Request is certainly sent before the home agent begins timing the registration Lifetime (also based on the granted Lifetime), this procedure ensures that the mobile node will re-register before the home agent expires and deletes the registration, in spite of possibly non-negligible transmission delays for the original Registration	Perkins Standards Track [Page 41]	
Μg	2243 2244 2245	2247 2247 2248 2249 2250 2251	2252 2253 2254 2254 2255 2255	2258 2258 2259 2260 2261 2263 2263	2266 2266 2267 2267 2268 2269	2271 2272 2273 2274 2276	2277 2277 2278 2280 2280 2281 2283 2284 2284	2289 2290 2291 2291 2293 2293 2294 2295	2296 2297 2298	

Ma	May 13 1998 10:38:26	rfc2002.txt	Page 42
299 300 301	RFC 2002 IP Mobi	Mobility Support 0ctober 1996	
303	Request and Reply that started mobile node and its home agent.	started the timing of the Lifetime at the $oldsymbol{L}$ is agent.	
306	3.6.2.3. Registration Request Denied	ied	
308	If the Code field indicates the node SHOULD log the error. In able to 'repair' the error. I	If the Code field indicates that service is being denied, the mobile node SHOULD log the error. In certain cases the mobile node may be able to "repair" the error. These include:	
312	Code 69: (Denied by foreig	(Denied by foreign agent, Lifetime too long)	
3114 3116 3117 3118	In this case, the Lifeti Contain the maximum Life Willing to accept in any MAY attempt to register in the Registration Requ the Value specified in t	In this case, the Lifetime field in the Registration Reply will contain the maximum Lifetime value which that foreign agent is willing to accept in any Registration Request. The mobile node MAY attempt to register with this same agent, using a Lifetime in the Registration Request that MUST be less than or equal to the value specified in the Reply.	
121	Code 133: (Denied by home	(Denied by home agent, Identification mismatch)	
222223	In this case, the Identification field in the R Reply will contain a value that allows the mobi synchronize with the home agent, based upon the protection in effect (Section 5.6). The mobile adjust the parameters it uses to compute the Idel hased upon the information in the Registribefore issuing any future Registration Requests	In this case, the Identification field in the Registration Reply will contain a value that allows the mobile node to synchronize with the home agent, based upon the style of replay potoection in effect (Section 5.6). The mobile node MNST adjust the parameters it uses to compute the Identification field based upon the information in the Registration Reply, before issuing any future Registration Reply,	•
31.	Code 136: (Denied by home	(Denied by home agent, Unknown home agent address)	
2333 2333 2334 2336 2341 342 342	This code is returned by performing dynamic home in Sections 3.6.1.1 and field within the Reply w the home agent returning attempt to register with Requests. In addition, parameters it uses to coupon the corresponding cissuing any future Regiss	This code is returned by a home agent when the mobile node is performing dynamic home agent address resolution as described in Sections 3.6.1.1 and 3.6.1.2. In this case, the Home Agent field within the Reply will contain the unicast IP address of the home agent returning the Reply. The mobile node MAY then attempt to register with this home agent in future Registration parameters. In addition, the mobile node SHOULD adjust the parameters it uses to compute the Identification field based upon the corresponding field in the Registration Reply, before issuing any future Registration Requests.	
44	3.6.3. Registration Retransmission		-
521 521 521 531 531 531	When no Registration Reply has time, another Registration Req timestamps are used, a new regeach retransmission; thus it cononces are used, the unanswered	When no Registration Reply has been received within a reasonable time, another Registration Request MAY be transmitted. When timestamps are used, a new registration Identification is chosen for each retransmission; thus it counts as a new registration. When nonces are used, the unanswered Request is retransmitted unchanged;	
53	Perkins Standards	rds Track [Page 42]	
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Page 43	-	
	t as a new registration (Section III) not require the home agent by issuing another nonce in the purishment of the registration Request.  Itin not require the home agent by issuing another nonce in the stawork.  Itin Request (rather than its stawork of the Registration Request. And the Registration Request. And the count for the size of the for transmission to the home milliseconds to allow for ining. The round trip time for at least as large as the time while ling. The round trip time to the Registration Requests MUST NOT Registration Requests MUST NOT Registration Requests MUST NOT be care of address.  Ver role in Mobile IP Request between mobile nodes the nettannission timeout period period as long as that is less the mobile node. It SHOULD messages to advertise its if not detectable by link-layer if not detectable by link-layer ga Registration Registration Registration ender to the gent MUST NOT transmit a ga Registration Registration and the foreign node. In particular, a stration Request or Reply ifetime has expired. A foreign ration Request message that deet however, it MUST relay ated by a mobile node.	[Page 43]
rfc2002.txt	lity Sugarter Salon was solved by the nation of count of stration will be used the salone will be between users of y in the between tration provides creation of salone will be salone. It is the between tration of salone will be salone will be salone. It is the between tration of salone will be salone will	Standards Track
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May	May 13 1998 10:38:26 rfc2	rfc2002.txt	Page 44
2411 2412 2413	RFC 2002 IP Mobility So	Support October 1996	
2414 2415 2415	3.7.1. Configuration and Registration Ta	Tables	_
2417 2417 2419 2420	Each foreign agent MUST be configured with a care-of address. In addition, for each pending or current registration, the foreign agent MUST maintain a visitor list entry containing the following information obtained from the mobile node's Registration Request:	d with a care-of address. In tregistration, the foreign agent ontaining the following node's Registration Request:	
2421 2423 2423 2423 2424 2426 2427	the link-layer source address of the mobile node the IP Source Address (the mobile node's Home Address) the IP Destination Address (as specified in 3.6.2.3) the UDP Source Port the Home Agent address the Identification field the Agent address the Identification field the Agent address the Identification field the Agent address the Identification field the Agent address the Identification field the Agent address the Identification field the Agent address the Identification field the Agent address the Identification field the Agent address the Identification field the Agent address the Identification field the Ident	the mobile node node's Home Address) scified in 3.6.2.3)	
2429		ne, and ding or current registration.	
2431 2432 2433 2433 2434 2435	As with any node on the Internet, a foreign agent MAN mobility security associations with any other nodes. Registration Request from a mobile node to its home foreign agent shares a mobility security association agent, it MUST add a Foreign-Home Authentication Extended.	the Internet, a foreign agent MAY also share octations with any other nodes. When relaying a from a mobile node to its home agent, if the a mobility security association with the home Authentication Extension to the	
2436 2437 2439 2440 2441	nest and MUST check the require asion in the Registration Repl 3.4). Similarly, when receivi the node, if the foreign agent oriation with the mobile node, pign Authentication Extension is 11e-Foreign Authentication Extension	td Foreign-Home Authentication  y from the home agent (Sections 3.3  my a Registration Request from a  shares a mobility security  it MUST check the required Mobile-  in the Request and MUST add a  mish net Request and MUST add a	
	the mobile node. 3.7.2. Receiving Registration Requests	-	<u> </u>
2446 2447 2448 2449 2450 2451 2453	If the foreign agent accepts a Registration Request from a mobile node, it then MUST relay the Request to the indicated home agent. Otherwise, if the foreign agent denies the Request, it MUST send a Registration Reply to the mobile node with an appropriate denial Code, except in cases where the foreign agent would be required to send out more than one such denial per second to the same mobile node. The following sections describe this behavior in more detain	tration Request from a mobile to the indicated home agent. ss the Request, it MUST send a with an appropriate denial gin agent would be required to rs second to the same mobile this behavior in more detail.	
2455 2455 2456 2457 2459 2460	If a foreign agent receives a Registration Request from a mobile nor in its visitor list, the existing visitor list entry for the mobile node SHOULD NOT be deleted or modified until the foreign agent receives a valid Registration Reply from the home agent with a Code indicating success. The foreign agent WUST record the new pending	ation Request from a mobile node vitor list entry for the mobile d until the foreign agent from the home agent with a Code it MUST record the new pending	
	Perkins Standards Track	ack (Page 44)	
	· .		

2523 2524 RFC 2002 IP 2525		UDP Sourc UDP Desti			Perkin	•
					-	
October 1996	ist entry for the lests deregistration, a node SHOULD NOT be successful indicates that the ais denied by the home mobile node MUST NOT tration Reply.	o UDP checksum MUST be equest MUST be checked. a mobility security	tication Extension MUST  of foreign agent MUST  If no Mobile-Foreign than one Mobile-Foreign than one Mobile-Foreign then took one Mobile The Request and The foreign agent also node with Code 67.	Registration Request, home agent as tration Request. The tration Request. The brough and including at the home agent. In s:  51 Dlowing the clion Extensions of and Extensions of and Extension if the home sociation with the home	[Page 45]	
IP Mobility Support	from the existing visitor I e Registration Request requiralist entry for the mobile oreign agent has received a If the Registration Reply ration or deregistration wisitor list entry for the sult of receiving the Registration	ks ts with an invalid, non-zer ation in the Registration R	Y one Mobile-receign Authen agistration Request, and thi ator value in the Extension sion is found, or if more ision is found, or if the A agent MUST silently disca as a security exception.	accepts the mobile node's accepts the mobile node's aguest to the mobile node's aguest to the mobile node's aguest to the mobile node's not modify any of the field send station Request up the first on the station Request up to not in agent proceeds as follow in agent proceeds as follow and remove any Extensions for its own non-authentical for its own non-authentical home agent, if applicable, here foreign-Home Authenticat in security as a mobility security as	Standards Track	
67 68 RFC 2002 69		m <sup>i</sup>	. ~	in in in in in in in in in in in in in i	5 6 6 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	
	PFU: 2002 IP Mobility Support October 1996 2524 RFC 2002 2524	RFC 2002 IP Mobility Support October 1996 2523  Request separately from the existing visitor list entry for the wibile node. If the Registration Request separatelon, the existing visitor list entry for the mobile node SHOULD NOT be deleted until the foreign agent has received a successful Registration Reply. If the Registration Reply indicates that the Registration or deregistration on deregistration was denied by the home 2531 agent, the existing visitor list entry for the mobile node NUST NOT be 2531 agent, the existing visitor list entry for the mobile node MUST NOT 2531 be modified as a result of receiving the Registration Reply.	Request separately from the existing visitor list entry for the mobile model from the existing visitor list entry for the mobile node SHOULD MOT be existing visitor list entry for the mobile node SHOULD MOT be existing visitor list entry for the mobile node SHOULD MOT be 2529  Redieted until the foreign agent has received a successful Moticates that the 2530  Redieted until the foreign agent has received a successful Moticates that the 2530  Redieted until the foreign agent has received a successful Moticates that the 2531  Redieted until the foreign agent has received a successful Moticates that the 2533  Redieted until the Registration Reply indicates that the 2533  Redieted until the Registration Reply. If the Registration Reply. If the Registration Reply. If the Registration Reply indicates that the 2533  Society of receiving the Registration Reply. If the foreign agent and the mobile node share a mobility security. Signature of the mobile node share a mobility security. Signature for the mobile node share a mobility security.	Request separately from the existing visitor list entry for the universal separately from the existing visitor list entry for the existing visitor list entry for the mobile node SHOULD be 2525 metalstand visitor list entry for the mobile node SHOULD be 2529 the existing visitor list entry for the mobile node SHOULD be 2529 the existing visitor list entry for the mobile node SHOULD more sequent (for registration or deregistration) was denied by the home 2531 agent, the existing visitor list entry for the mobile node NUST NOT be modified as a result of receiving the Registration Reply.  3.7.2.1. Validity Checks  Registration Request with an invalid, non-zero UDP checksum MUST be 2538 slently discarded.  Also, the authentication in the Registration Request MUST be checked.  If the foreign agent and the mobile node share a mobility security be 2540 association, exactly one Mobile-Foreign Authentication are Mobile-Foreign Authenticator value in the Extension I I no Mobile-Foreign 2540 and the Authenticator value in the Extension I I no Mobile-Foreign Authentication Extension is found, or if more than one Mobile-Foreign Authentication Extension is found, or if more than one Mobile-Foreign SHOMILD hog the events as a security exception. The foreign agent MUST silently discard the Request and SHOMILD hog the events as a security exception. The foreign agent also 2540 SHOMILD hog the events as a security exception. The foreign agent also 2541 SHOMILD hog the events as a security exception. The foreign agent also 2541 SHOMILD hog the events as a security exception. The foreign agent also 2541 SHOMILD hog the events as a security exception. The foreign agent also 2541 SHOMILD how a read a registration Reply to the mobile rode with Code 67.	Request separately from the existing visitor list entry for the month in the existing visitor list entry for the month in mode since the request defergistration, the existing visitor list entry for the mobile node SiGOLD MOT be delicted until the foreign agent has received a successful control of the Registration Reply indicates that the Registration is the Registration was denied by the home agent. The Registration is the Registration was denied by the home agent. The Registration is the Registration was denied by the home agent. The Registration of deregistration was denied by the home agent. The Registration is the Registration Reply.  17.2.1. Validity Checks  Maps. the authentication in the Registration Request WUST be checked.  17.2.1. Validity Checks  Registration Request with an invalid, non-zero UDP checksum MUST be satisfied to case the mobile foreign agent WUST checked.  17.2.1. Validity discarded.  Maps. the authentication in the Registration Request WUST be checked.  17.2.1. Validity discarded.  Maps. the authentication in the Registration Request WUST be checked.  17.2.1. Validity discarded.  Maps. the Authentication is found. Or if more than one bobile-foreign has assemble to the Registration Registration Reguest and Simular the Content in Schund. Or if the Authenticator value in the Extension. If no Mobile-Foreign in Found or if the Authenticator value in the Registration Request.  17.2.2. Forwarding a Valid Request to the Home Agent. The foreign agent WOST silently discard the Request and Simula went acceptly the mobile node: Registration Request. The foreign agent work was an exercity verse to the Home Agent. In the Numer Agent to the Modile Home Authentication Extension Extension Extension Extension Extension Extension Extension Extension Active the Modile-Home Authentication Extension Extension Extension Extension Silently Modile-Home Authentication Extension Extension Extension Extension Extension Silently association Extension Silently agent the Modile-Home Authentication Extension Extensio	Here 1002 It Publity Support October 1996 2533 Here existing visitor list entry for the multi- under if the featurest classical dergalstration, which under if the featurest classical dergalstration, and the existing visitor list entry for the mobile mode smooth the between the creditation with the mode of the making with the manifold mode of the making with the manifold mode of the making with the list of the creditation was dendered by the modern to astating without list of the creditation was dendered by the modern to astating without list of the making with list of the mak

May	May 13 1998 10:38:26	rfc2002.txt	Page 46
523 524 525	RFC 2002	IP Mobility Support October 1996	
526 527 528	Specific fields with: relayed Registration	Specific fields within the IP header and the UDP header of the relayed Registration Request MUST be set as follows:	
530	IP Source Address The forei	. Address The foreign agent's address on the interface from which the message will be sent.	
5334	IP Destination Add Copied fr Request.	IP Destination Address Copied from the Home Agent field within the Registration Request.	
233	UDP Source Port <variable></variable>		
124	UDP Destination Port	ורב	
2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	After forwarding a vaforeign agent MUST be registration based or this lifetime expires the foreign agent MUST registration.	After forwarding a valid Registration Request to the home agent, the foreign agent MOST begin timing the remaining lifetime of the pending registration based on the Lifetime in the Registration Request. If this lifetime expires before receiving a valid Registration Reply, the foreign agent MUST delete its visitor list entry for this pending registration.	
553	3.7.2.3. Denying Invalid Requests	Reguests	
25555555555555555555555555555555555555	If the foreign agent for any reason, it SH with a suitable denia Agent, and Identifica copied from the corre	If the foreign agent denies the mobile node's Registration Request for any reason, it SHOULD send the mobile node a Registration Reply with a suitable denial Code. In such a case, the Home Address, Home Agent, and Identification fields within the Registration Reply are copied from the corresponding fields of the Registration Request.	
2000 2000 2000 2000 2000 2000 2000	If the Reserved field Request and SHOULD rethe mobile node. If requested Lifetime is in the Reply to the many Registration Requite Lifetime SHOULD b	If the Reserved field is nonzero, the foreign agent MUST deny the Request and SHOULD return a Registration Reply with status code 70 to the mobile node. If the Request is being denied because the requested Lifetime is too long, the foreign agent sets the Lifetime in the Reply to the maximum Lifetime value it is willing to accept in any Registration Request, and sets the Code field to 69. Otherwise, the Lifetime SHOULD be copied from the Lifetime field in the Request.	
68	Specific fields within Registration Reply MU	Specific fields within the IP header and the UDP header of the Registration Reply MUST be set as follows:	
571 572 573 573 573	IP Source Address Copied frr Request, v used. In	Address Copied from the IP Destination Address of Registration Request, unless the "All Agents Multicast" address was used. In this case, the foreign agent's address (on the interface from which the message will he sent) MUST be	
577	Perkins	Standards Track   Page 46	
	er.		
			- <u>.</u>

May 13 1998 10:38:26	2635 2636 RFC 2002 2637	2638 log the event as a 2639 log the event as a 2640 reject the mobile 2641 Reply to the mobil 2642 and 3 3 3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5				2653 instead, the Code in 2654 foreign agent MUST 2655 Finally, if the Code 2656 the home agent, the 2657 registration list and 18th and 1		266 additional procedur 266 - It MUST process 2668 Mobile-Home Auth 269 - IT MAY around in	<i>ច</i> ដ		2687 2688 2689 2690 Perkins	
Page 47												
May 13 1998 10:38:26 rfc2002.txt	12 IP Mobility Support October 1996	used. IP Destination Address Copied from the IP Source Address of the Registration Request.	UDP Source Port 434	UNP Destination Port Copied from the UDP Source Port of the Registration Request.	3.7.3. Receiving Registration Replies	The foreign agent updates its visitor list when it receives a valid Registration Reply from a home agent. It then relays the Registration Reply to the mubile node. The following sections describe this behavior in more detail.	If upon relaying a Registration Request to a home agent, the foreign agent receives an ICMP error message instead of a Registration Reply, then the foreign agent SHOULD send to the mobile node a Registration Reply with an appropriate "Home Agent Unreachable" failure Code (within the range 80-95, inclusive). See Section 3.7.2.3 for details on building the Registration Reply.	3.7.3.1. Validity Checks Registration Replies with an invalid, non-zero UDP checksum MUST be sitently discarded.	When a foreign agent receives a Registration Reply message, it MUST search its visitor list for a pending Registration Request with the same mobile node home address as indicated in the Reply. If no pending Request is found, the foreign agent MUST silently discard the Reply. The foreign agent MUST also silently discard the low-order 32 bits of the identification field in the Reply do not match those in the Request.	Also, the authentication in the Registration Reply MUST be checked. If the foreign agent and the home agent share a mobility security assuciation, exactly one Foreign-Home Authentication Extension MUST chee present in the Registration Reply, and the foreign agent MUST check the Authenticator value in the Extension. If no Foreign-Home Authentication Extension is found, or if more than one Foreign-Home Authentication Extension is found, or if the Authenticator is invalid, the foreign agent MUST silently discard the Reply and SHOULD	Standards Track (Page 47)	
/lay 13 1	79 80 RFC 2002 81	5883 5885 587 587	# & C :	<b>-</b> 6 5 4				ω 			2 3 4 Perkins	
_	2579 2580 2581 2581	2583 2583 2584 2585 2586	2589 2589 2590	2591 2592 2593 2594	2595 2596 2597	2598 2599 2600 2601 2601	2603 2604 2605 2606 2606 2608	261 261 261 261 261 261 261 261 261 261	2615 2617 2618 2619 2620 2621	2623 2624 2624 2625 2626 2627 2629 2629 2630	2633 2633 2634	

Ma	May 13 1998 10:38:26	rfc2002.txt	Page 4	48
2635 2636 2637	RFC 2002 IP Mobility	Support	October 1996	
2639 2639 2640 2641 2641	log the event as a security exception. The foreign agent also MUST reject the mobile node's registration and SHOULD send a Registration Reply to the mobile node with Code 68.	eption. The foreign agent a ration and SHOULD send a Req ode 68.	ilso MUST Jistration	
2643	3.7.3.2. Forwarding Replies to the Mobile Node	Mobile Node		
2645	A Registration Reply which satisfies the validity checks of Section	sfies the validity checks of	Section	
2647	update its visitor list entry f	e node. The foreign agent b or the mobile node to reflec	UST also	
2649	results of the Registration Request, as indicated by the Code field in the Reply. If the Code indicates that the mobile and the	uest, as indicated by the Constant the mobile and a	de field	
2650	accepted the registration and the Lifetime field is nonzero, the	he Lifetime field is nonzero	as , the	
2652	value specified in the Lifetime	time in the visitor list ent field of the Registration B	ry to the	
2653	instead, the Code indicates that the Lifetime field is zero, the	t the Lifetime field is zero	the	_
2655	Finally, if the Code indicates	isicor list entry tor the mo that the registration was de	bile node. nied hv	
2656	the home agent, the foreign agent MUST delete its pending	nt MUST delete its pending	for man	_
2658	registration itst entry, but not its visitor list entry, mobile node.	c its visitor list entry, fo	for the	
2659				
2660	The foreign agent MUST NOT modi	foreign agent MUST NOT modify any of the fields beginning with	ng with	
2992	the Mobile-Home Authentication	ration Reply up through and Extension. Otherwise an	including	
2663	authentication failure is very likely to occur at the mobil	likely to occur at the mobile node	e node.	
2665	in addition, the foreign agent additional procedures.	SHOULD perform the following		_
2666				
2667	It MUST process and remove any Extensions following the	ny Extensions following the		
2669	The MAY appeal its action Ex	rtension,		
2670	to may append its own non-authentication Extensions of relevance to the mobile node. if annlicable and	Thentication Extensions of reaches and	elevance	
2671	- It MUST append the Mobile-For	eign Authentication Extensi	on. if	
2672	the foreign agent shares a mobility security association with the	bility security association	with the	_
2674	monte none.			_
2675	Specific fields within the IP header and the UDP header of the	ader and the UDP header of	e H	
2677	relayed Registration Reply are set according to the same rules	et according to the same ru	les	
2678	Specified in Section 3.7.2.3.			
2679	After forwarding a valid Registration Reply to the mobile node, the	ation Reply to the mobile n	ode, the	
2681	registration as follows if the	sitor list entry for this		
2682	the registration was accepted by the home agent. The foreign agent	the home agent, the foreign	es that	
2683	resets its timer of the lifetime	of the registration to the	Lifetime	_
2685	granted in the Registration Repl	y; unlike the mobile node's	timing of	_
2686	foreign agent considers this lifetime to begin when it forwards the	cribed in Section 3.6.2.2, etime to begin when it forw	the ards the	_
2687				
2690	Perkins	Crandarde Grani	;	
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May 13 19	2747 2748 RFC 200 2749		2756 den 2757 detc 2759 3.8.2.1 2760 Regi 2761 Regi 2762 silk	2764 The 2765 invo 2767 e 2767 e 2768	22710 2771 2771 2771 2775 2776 2777	2780 b 2781 2782 2783	2784 2785 2786 2787 2788 2790 2791 2793 2794	2796 2797 2798 2799 2799	2802 2802 2802 Perkins
Page 49	<del></del>			<u> </u>					
	October 1996	ign agent will not s. On the other registration was tes its visitor	on process. The mobile node record of the a suitable	v except when mobile node. In stration Reply to	uss and with the Mary he configured tion of each agent. When the me amobile node "create or modify ling list	ерТу	associations with ion Request from a security MMST check the cation Extension origin agent, if on with the his mobility		(Page 49)
rtc2002.txt	IP Mobility Support	Registration Reply message, ensuring that the foreign agent will not expire the registration before the mobile node does. On the other hand, if the Registration Reply indicates that the registration was rejerted by the home agent, the foreign agent deletes its visitor list entry for this attempted registration.	i. Home Agent Considerations Home agents play a reactive role in the registration process. Thome agent receives Registration Requests from the mobile node (perhaps relayed by a foreign agent), updates its record of the mobility bindings for this mobile node, and issues a suitable Registration Reply in response to each.	A home agent MUST NOT transmit a Registration Reply except when replying to a Registration Request received from a mobile node. In particular, the home agent MUST NOT generate a Registration Reply to indicate that the Lifetime has expired.	Fach home agent MUST be configured with an IP address and with the profix size for the home network. The home agent MUST be configured with the home address and mobility security association of each authorized mobile node that it is serving as a home agent. When the home agent accepts a valid Registration Request from a mobile node that it serves as a home agent, the home agent MUST create or modify the entry for this mubile node in its mobility binding list	the mobile node's care-of address the Identification field from the Registration Reply the remaining Lifetime of the registration	The home agont MAY also maintain mobility security associations with various foreign agents. When receiving a Registration Request from a foreign agent, if the home agent shares a mobility security association with the foreign agent, the home agent MUST check the Authunticatur in the required Foreign-Home Authentication Extension in the message, based on this mobility association. Extension Similarly, when sending a Registration Reply to a foreign agent, if foreign agent shares a mobility security association with the foreign agent, the home agent MUST include a Foreign-Home Authentication Extension in the message, based on this mobility security association.	ration Requests	Standards Track
May 13 1998 10:38:26	RFC 2002		m E	E.				3.8.2. Receiving Registration Requests	Perkins
2	2692 2693 2693 2694	2695 2695 2697 2698 2699 2699 2700	2701 2702 2703 2703 2704 2706 2707	2709 2710 2711 2712 2712 2713 2713	2715 2716 2717 2718 2719 2720 2721 2721 2722 2723	2725 2726 2726 2727 2728	2729 2730 2731 2732 2733 2734 2734 2735 2736 2736 2737 2738	2742 2742 2743 2744	2746

Мау	13 18	May 13 1998 10:38:26	rf	rfc2002.txt		Page 50
2747 2748 2749	RFC 20	2002	IP Mobility	Mobility Support	October 1996	
2751 2753 2754 2755 2756 2757	If upc SHC (t) Reg den	If the home agent acce update its record of the SMOULD send a Registra (the home agent denies Reply with an appropridanied. The following detail.	epts an incommunity the the mobil that ion Reply we the Request the Code speciate Code speciate Code speciate Code speciate Code speciate Code speciate Code speciate Code speciate Code speciate Code speciate Code speciate Code speciate Code speciate Code speciate Code speciate Code speciate Code speciate Code speciate Code speciate Code Speciate Code	If the home agent accepts an incoming Registration Request, it MUSI update its record of the the mobile node's mobility binding(s) and SHOULD send a Registration Reply with a suitable Code. Otherwise (the home agent denies the Request), it SHOULD send a Registration Reply with an appropriate Code specifying the reason the Request wadenied. The following sections describe this behavior in more detail.	t, it MUST ng(s) and therwise istration Request was more	
2759	3.8.2.	8.2.1. Validity Checks				
2761	Reg	Registration Requests of Silently discarded by	with an invalid the home agent.	Registration Requests with an invalid, non-zero UDP checksum MUST be silently discarded by the home agent.	sum MUST be	
2765	The	The authentication in the Registra involves the following operations:	the Registra 1 operations:	The authentication in the Registration Request MUST be checked. involves the following operations:	ecked. This	
2769 2769 2770 2771 2771 2772 2773 2775 2775 2776 2776		The home agent Mobile-Home Aui indicated auth Authentication Request, and tl value in the Extension is for Authentication is invalid, the registration aregistration mobile node with	Authentication Ext Authentication Ext Intentication Exa Into Extension MUST I To Extension If no Extension. If no Found, or if more fon Extension is for the home agent MUST In and SHOULD send a with Code III. The and SHOULD log the	The home agent MUST check for the presence of a valid Mobile-Home Authentication Extension, and perform the indicated authentication. Exactly one Mobile-Home Authentication Extension and MUST be present in the Registration Request, and the home agent MUST check the Authenticator Value in the Extension. If no Mobile-Home Authentication Extension is found, or if more than one Mobile-Home Authentication Authentication Extension is found, or if the Authenticator is invalid, the home agent MUST reject the mobile node's registration and SHOULD send a Registration Reply to the mobile node with Code 131. The home agent MUST then discerd the Request and SHOULD log the error as a security exception.	alid the sgistration ticator tication ne ne node's to the en discard	
2780 2781 2782 2783 2784 2785 2786 2786 2786		The home agent MUST check that the regidentification field is correct using the SPI within the Nobile-Home Authent Section 5.6 for a description of how tincorrect, the home agent MUST reject send a Registration Reply to the mobil including an Identification field compthe rules specified in Section 5.6. The further processing with such a Regulog the error as a security exception.	MUST check field is co the Mobile-I r a descript. home agent I ation Reply I dentification ified in Sect cessing with as a security	The home agent MUST check that the registration Identification field is correct using the context selected by the SPI within the Mobile-Home Authentication Extension. See Section 5.6 for a description of how this is performed. If incorrect, the home agent MUST reject the Request and SHOULD send a Registration Reply to the mobile node with Code 133, including an identification field computed in accordance with the rules specified in Section 5.6. The home agent MUST do no further processing with such a Request, though it SHOULD log the error as a security exception.	selected by ension. See end SiGOULD Code 133, rdance with tt MUST do	
2791 2792 2793 2794 2795 2796 2797 2797 2799	-	c) If the home age the foreign age of a valid Fore one Foreign-Hom the Registratio MUST check the Foreign-Home Au	ent shares a ent, the home eign. Home Aut me Authentics on Reguest ir Authenticatouthentication Jn-Home Authentign.	If the home agent shares a mobility security association with the foreign agent, the home agent MUST check for the presence of a valid Foreign-Home Authentication Extension. Exactly one Foreign-Home Authentication Extension MUST be present in the Registration Request in this case, and the home agent in MUST check the Authenticator value in the Extension. If no Foreign-Home Authentication Extension is found, or if more than one Foreign-Home Authentication Extension is found, or	iation with the presence Exactly present in persent in persent in the agent n. If no if more found, or	
_	Perkins		Standards	Track	[Page 50]	

if the Authentirator is invalid, the home agent MUST reject the mobile index is rejection and Signub Send a Registration mobile index to make the color into the mobile index in the color into the mobile index in the color into the mobile index in the color into the mobile index in the mobile index is mobile index in the mobile index in the mobile index in the mobile index in the mobile index in the mobile index in the mobile index in the mobile index in the mobile index in the mobile index in the mobile index in the mobile index in the mobile index in the mobile index in the mobile index in the mobile index in the mobile index in the mobile index in the mobile index ind	Maj	May 13 1998 10:38:26	rfc2002.txt	4	Page 51
Per Per Per Per Per Per Per Per Per Per	2803 2804 2805	RFC 2002	IP Mobility Support		
Per ?	2806 2807 2808 2819 2810	if the Auther the mobile: Reply to the MUST then dissecurity exc	nticator is invalid, the home agent ode's registration and SHOULD send mobile node with Code 132. The hoscard the Request and SHOULD log the eption.	MUST reject a Registration me agent e error as a	
Perkins	2813 2813 2814 2815 2817 2817 2820 2820	In addition to check Request, home agents the submet-directed to being unicast to Request and SHOULD. In this case, the Reunicast address, so Registration Request.	ing the authentication in the Regiss MUST deny Registration Requests the broadcast address of the home netwo the home agent. The home agent MUST action Reply with gistration Reply will contain the hilat the mobile node can re-issue that the Correct home agent address.	tration at are sent to rk (as opposed ST discard the a Code of 136. ome agent's	
The bind	2824 2825 2825 2825 2826 2827 2827 2829 2830	If the Registration 3.8.2.1, and the hom home agent MUST upda mubile node and MUST in this case, the Re Supports simultaneous Section 3.8.3 for de	Request Recises the validity check e agent is able to accommodate the let its mobility binding list for the return a Registration Reply to the ply Code will be either 0 if the hos mobility binding, or 1 if it does tails on building the Registration if it does not building the Registration in the stails on building the Registration is	ks in Section Request, the a requesting mobile node. ne agent s not. See	
Perkins	2832 2833 2833 2835 2836 2838 2839	The home agent updat bindings as follows.  If the Lifetime hode's home address home address home is how a mobile is how a mobile mobility service	based on the fields in the Registrates on the fields in the Registrates are series, the home agent deletes all of thing list for the requesting mobile lode requests that its home agent of	nobility ation Request: als the mobile the entries in node. This	
Perkins	2841 2842 2843 2844 2846 2846 8848	- If the Lifetime the mobile node entry containing binding list for entries containing If the Lifetime containing the relist for the mobile the forth mobile for the mob	is zero and the Care-of Address does home address, the home agent delet the specified Care-of Address from the requesting mobile node. Any ot no other care-of addresses will remais nonzero, the home agent adds an equested Care-of Address to the mobile node. If the 'S' hir is ear and	inot equal ies only the the mobility ther active in active. antry antry the binding	
Standards Track .	850 851 853 853 855 855	agent supports a mobility binding removes all prev mobile node.	The move and the symptom to the symptom multaneous mobility bindings, the pentries are retained. Otherwise, to ous entries in the mobility binding	the home revious he home agent list for the	
	r n		Standards Track	[Page 51]	

May	13 19	May 13 1998 10:38:26	rfc2002.txt		Page 52
2859 2860 2861	RFC 2002	02	IP Mobility Support	October 1996	
2862	In a	In all cases, the home	Adent MIRT cend a		
2864	source	rce of the Registrateion agent than than	Registration Request, which might indeed be a	negration Reply to the	
2866	(de)	registered. If the	(de) registered. If the home agent shares a mobility security	ecurity	
2868	dere	ociation with the forest	oreign agent whose care-of addre foreign agent is different from	ss is being the one which	
2869	rela	ayed the Registration	relayed the Registration Request, the home agent MAY addition	additionally	
2871	is b	being deregistered.	Jiy to the loreign agent whose care-of address The home agent MUST NOT send such a Renlv if	are-of address uch a Renly if	
2872 2873	it c agen	loes not share a molit. If no Reply is	it does not share a mobility security association with the foreign agent. If no Reply is sent the foreign arent's rights like in the foreign arent's rights like in the foreign arent's rights like in the foreign arent's rights like in the foreign arent's rights like in the foreign arent's rights like in the foreign arent's rights like in the foreign arent	the foreign	
2874	expi	ire naturally when t	cont, the latery, agent a vision the original Lifetime expires.	or tist will	
2876	The	home agent MUST NOT	increase the Lifetime above the		
2877	the	mobile node in the	Registration Request. However,	it is not an	
2879	agen	of is willing to acc	erior for the mobile node to request a Lifetime longer than the home agent is willing to accept. In this case, the home agent simply	than the home	
2880	redu	ices the Lifetime to	a permissible value and return	s this value in	
2882	info	registration Reply. Trms the mobile node	the Registration Reply. The Lifetime value in the Registration Reply informs the mobile node of the granted lifetime of the registration	istration Reply	
2883	indi	cating when it SHOU	JLD re-register in order to maint	tain continued	•
2885	home	home agent MUST delete	oration of this registration lifetime, its entry for this registration in its	fetime, the in its	
2886	idom	lity binding list.		1	
2888	If t	he Registration Req	If the Registration Request duplicates an accepted current	rent	
2889	Regi	stration Request, t	he new Lifetime MUST NOT extend	beyond the	
2891	if t	he home address, ca	if the home address, care-of address, and Identification fields all	s a duplicate on fields all	
2892	equal	d those of an accepted current	ted current registration.		
2894	Ina	ddition, if the hom	e network implements ARP [16], a	and the	
2896	Regi	stration Request as	ks the home agent to create a mo	obility binding	
2897	was	previously assumed	tot a moutie node which previously had no binding (the mobile node was previously assumed to be at home), then the home agent Mich	mobile node	
2898	fo11	ow the procedures d	escribed in Section 4.6 with reg	Jard to ARP,	
2900	prox	y ARP, and gratuito ious mobility bindi	proxy ARP, and gratuitous ARP. If the mobile node already previous mobility binding. The home amont MIST continue	eady had a	
2901	rule	s for proxy ARP des	cribed in Section 4.6.	ב כם דמוומת כוום	
	3.8.2.3	3.8.2.3. Denying an Invalid Request	d Reguest		
2904	16	, de			
2906	in Se	in the registration Reply does not in Section 3.8.2.1. or the home and	ty does not satisfy all of the v the home agent is unable to age	of the validity checks	
2907	Regue	est, the home agent	SHOULD return a Registration Re	mundage the	
2908	mobi.	le node with a Code	that indicates the reason for t	he error. If	
2910	fore	ign agent to delete	foreign agent to delete its pending visitor list entry. Also, this	nis allows the Also, this	
2911					-
2913 2914 F	Perkins		Standarde Grack		
	}		Standards Hack	[Page 52]	-
<u></u>		٠			
					_

May 13 1998 10:38:26	2971 2972 RFC 2002 2973 2974	2975 UDP Source Port 2976 Copied 2977 Reques 2978 UDP Destination 2980 Copied 2981 Reques	When sending Request that Lifetime is home address mobile node' mobile node IP Destinati		3004 existing binding 13005 transmit this Reply 3006 transmit this Reply 3006 transmit this Reply 3006 This section provident for the fields with 3011 code field of the 3012 rules specified in 3013 accepted registration 3015 med the fields with 3011 accepted registration 3015 med the fields in 3011 accepted registration 3015 med the fields in 3015 med the fields in 3015 med the fields in 3015 med the fields in 3015 med the fields in 3015 med the fields in 3015 med the fields in 3015 med the fields in 3015 med the fields in 5015 med the fields in	3070 Registration Requests 3018 Registration Requests 3018 maximum length of the 3020 length of time that 3021 agent. This reduces 3023 by the home agent (1928) 3025 set ins.	- <u>-</u>
Page 53							
rfc2002.txt	IP Mobility Support 0ctober 1996	Intorms the mobile node of the reason for the error such that it may attempt to fix the error and issue another Request.  This section lists a number of reasons the home agent might reject a Request, and provides the Code value it should use in each instance. See Section 3 8.3 for additional details on building the Registration Reply message.	Many reasons for rejecting a registration are administrative in mature. For example, a home agent can limit the number of simultaneous registrations for a mobile node, by rejecting any registrations that would cause its limit to be exceeded, and returning a Registration Reply with error code 135. Similarly, a home agent may refuse to grant service to mobile nodes which have entered unauthorized service areas by returning a Registration Reply with a Code of 129.	If the Reserved field is nonzero, it MUST deny the Request with a Code of 134.  1.3. Sending Registration Replies If the home agent accepts a Registration Request, it then MUST update its record of the mobile nude's mobility binding(s) and SHOULD send a Registration Reply with a suitable Code. Otherwise Ithe home agent has denied the Request, it SHOULD send a Registration Reply with an appropriate Code specifying the reason the Request was denied. The following sections provide additional detail for the values the home agent MUST supply in the fields of Registration Reply with an appropriate Code specifying the reason the Request was denied. The additional detail for the values the home agent MUST supply in the fields of Registration Reply messages	This section provides the specific rules by which mobile nodes pick values for the IP and UDP header fields of a Registration Reply.  IP Source Address Copied from the IP Destination Address of Registration Request, unless a multicast or broadcast address was used. If the IP Destination Address of the Registration Request was a broadcast or multicast of the Registration Source Address of the Registration Source Address of the Registration Source Address of the Registration Source Address of the Registration Source Address of the Registration Reply MUST be set to the home agent's functions.	ation Address Copied from the IP Source Address of the Registration Request. Standards Track [Page 53]	
May 13 1998 10:38:26	2915 2917 RFC 2002 2918 2918 :			2936 2917 2918 2918 2919 2919 2919 2919 2919 292 2939 2940 2941 2941 2942 2941 2942 2943 2943 2943 2944 2945 2945 2945 2945 2945 2945 2945	m w	2961 2962 IP Destination Address 2963 Copied from t 2964 Request. 2965 2967 2968 2968 2969 2970 Perkins	

May	May 13 1998 10:38:26	rfc2002.txt	Pa	Page 54
	RFC 2002	IP Mobility Support	October 1996	
974 975 976 977	UDP Source Port Copied f Request.	rom the UDP Destination Port	of the Registration	-
980	UDP Destination P Copied f Request.	ort rom the UDP Source Port	of the Registration	
9982 9983 9985 9998 990	When sending a Reg Request that reque Lifetime is zero a home address) and mobile node's home mobile node to der IP Destination Add mobile node's home	When sending a Registration Reply in response to a Registration Request that requested deregistration of the mobile node (the Lifetime is zero and the Care-of Address equals the mobile node's home address and in which the IP Source Address was also set to the mobile node's home address (this is the normal method used by a mobile node to deregister when it returns to its home network), the IP Destination Address in the Registration Reply will be set to the mobile node's home address, as copied from the IP Source Address of the Request.	egistration nobel (the nobile node's also set to the 1 used by a s network), the 1 be set to the irce Address of	
993 9994 9996 999 999 999 999 999 999 999 9	In this case, wher agent MUST transmithe mobile node we entry that may stimobile node. In pheing registered w Registration Requessemobile node's registration Requessemobile node's registration Reply Registration Reply existing binding I transmit this Repli	the Registrativectly onto the Vpassing any make home agent a mobile not address, if the Vpassing and make the Vpassing the	ion Reply, the home the home network as if nobility binding list for the destination a returning home after he mobile node's new nome agent, the mobility itil indicate that he tunneled to the na sending the na sending the fithis Request, this of this Request, this eat home agent MUST	· · · · · · · · · · · · · · · · · · ·
	3.8.3.2. Registration Reply Fields This section provides specific of the fields within the fixed Code field of the Registration frules specified in the previous accepted registration, a home at does not support simultaneous re	1.3.2. Registration Reply Fields This section provides specific rules by which home agents pick values for the fields within the fixed portion of a Registration Reply. The Code fitod of the Registration Reply is chosen in accordance with the rules specified in the previous sections. When replying to an accepted registration, a home agent SHOULD respond with Code 1 if it does not support simultaneous registrations.	ents pick values tion Reply. The ordance with the ing to an th Code 1 if it	
016 017 019 020 022 023	The Lifetime field Registration Reque maximum length of requested service. length of time that agent. This reductby the home agent	The Lifetime field MUST be copied from the corresponding field in the Registration Request, unless the requested value is greater than the maximum length of time the home agent is willing to provide the requested service. In such a case, the Lifetime MUST be set to the length of time that service will actually be provided by the home agent. This reduced Lifetime SHOULD be the maximum Lifetime allowed by the home agent (for this mobile node and care-of address).	ing field in the reater than the rovide the be set to the by the home by the home ddress).	
	Perkins	Standards Track	[Page 54]	
	e .			

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	2001 Solder		iling datagrams using touses a co-located trumeled using IP in GRE encapsulation optionally be he use of these d by the mobile agent.		operates without	erates in the same hod by which a ed to its home cated care-of ICMP Router	node chooses a	ign agent care-of default router	the ICMP Router ment message. The Advace of the Agent	the IP address of a V) list of Router coortion of the coortion of the Sa MUST be considered	a detaute foucer.	Tas home agent  Tas home agent  Pertised in any  Pertised in any  Pertises or which  Revuer Address  Rode's externally  address of the  Per mobile nucle  tother possible  along with the  along with the	[Page 56]	
rfc2002 txt	IP Mobility Support		Home agents and foreign agents MUST support tunneling datagrams using IP in IP encapsulation [14]. Any mobile node that uses a co-located care-of address MUST support receiving dategrams tunneled using IP in IP encapsulation. Minimal encapsulation [15] and GRE encapsulation [8] are alternate encapsulation methods which MAY optionally be supported by mobility agents and mobile nodes. The use of these alternative forms of encapsulation, when requested by the mobile node, is otherwise at the discretion of the home agent.	outing	derations  home network, a mobile node	way as any other (fixed) host or router. The method by which a mobile node selects a default router when connected to its home network, or when away from home and using a co-located care-of address, is outside the scope of this document. ICMP Router Addertisement [4] is one such method.	When registered on a foreign network, the mobile node chooses default router by the following rules:	If the mobile node is registered using a foreign agent care-of address, then the mobile node MUST choose its default router	uter Addresses advertised in tion of that Agent Advertise Iso consider the IP source a	Advertisement as another possible choice for the IP address of a default router, along with the (possibly empty) list of Router Addresses from the ICMP Router Advertisement portion of the massage. In such cases, the IP source address MUST be considered to be the Worst choice (lowest preference) for a Administration of the massage.	of the work of the control of the co	using a co-located care-of address, then the mobile node SHOULD choose its default router from among those advertised in any ICMP Router Addrestisement message that it receives for which its externally obtained care-of address and the Router Address match under the network prefix. If the mobile node's externally obtained care-of address matches the IP source address of the Agent Advertisement under the network prefix, the mobile node MAY also consider that IP source address as another possible choice for the IP address of a default router, along with the (possibly empty) list of Router Addresses from the ICMP Router	Standards Track	
May 13 1998 10:38:26	3083 3084 RFC 2002	3085 3086 3087 4.1. Encapsulation Types		4	7			t				125 using a co-located shall be a consider by a consider b	1136 3137 3138 Perkins	
				-										
Page 55														
	October 1996	orresponding field in	est contains a cald MUST be copied pDIy. Therwise, the Registration Reply to ome agent MUST reject to 136) to prevent the egistered with two or		red and any optional o a Registration	r, followed by the Reply, sions used by the	200	, sions used only by	n, if present.	Registration Reply are optional. agent and the ion.		rom mobile nodes that rode informs its home in procedure in procedure when the address with respect it respect to any itser.	[Page 55]	
rfc2002.txt	IP Mobility Support	The Home Address field MUST be copied from the corresponding field in the Registration Pequest.	If the Home Agent field in the Registration Request contains a unicast address of this home agent, then that field MUST be copied into the Home Agent Lield of the Registration Reply. Therwise, the Home agent MUST set the Home Agent field in the Registration Reply to its unicast address. In this latter case, the home agent MUST reject the registration with a suitable code (e.g., Code 136) to prevent the mobile node from possibly being simultaneously registered with two or		This section describes the ordering of any required and any optic Mobile IP Extensions that a home agent appends to a Registration Reply. The following ordering MUST be followed:	The IP header, followed by the UDP header, fol fixed-length portion of the Registration Reply I present, any non-authentication Extensions	agent), The Mobile-Home Authentication Extension	If present, any non-authentication Extensions the foreign agent, and	The Foreign-Home Authentication Extension, if	Note that items (a) and (c) MUST appear in every Registration Reply sent by the home agent. Items (b), (d), and (e) are optional. However, item (e) MUST be included when the home agent and the foreign agent share a mobility security association.	tions	This section describes how mobile nodes, home agents, and (possibly) foreign agents cooperate to route datagrams to/from mobile nodes that are connected to a foreign network. The mobile node informs its home agent of its current loaction using the registration procedure described in Section 3. See the protocol overview in Section 1.7 for the relative locations of the mobile node's home address with respect to its home agent, and the mobile node itself with respect to any foreign agent with which it might attempt to register.	Standards Track	·
May 13 1998 10:38:26	3027 3028 RFC 2002 3029			m #.	3045 This section desc 3046 Mobile IP Extensi 3047 Reply. The follo	a) b)	3054 agent), 1055 c) The Mobil	Ð	(e)		1068 4. Routing Considerations		io82 Perkins	

Page 56

May	May 13 1998 10:38:26	rfc2002.txt	Page 57	May 13 1998 10:38:26	38:26
3139	RFC 2002	if Mobility Support October 1996	966	3195 3196 RFC 2002 3197	
3143 3144 3145 3146 3148	Advertisement port address MOST be co preference) for a be obtained from t Advertisement, if through other mech	Advertisement portion of the message. If so, the IP source address MUST be considered to be the worst choice (lowest preference) for a default router. The network prefix MAY be obtained from the Prefix-Lengths Extension in the Router Advertisement, if present. The prefix MAY also be obtained through other mechanisms beyond the scope of this document.		1198 1199 4.2.3. Home Agent Con 1200 1201 The home agent MUS 1202 network addressed 1203 registered away fr 1204 enabling this ince	gent Con gent MUS dressed away fr
3150 3151 3152 3153 3153	Beyond these rules, the made by the selection among the Router Address node registered via a default router.	Beyond these rules, the actual selection of the default router is made by the selection method specified for ICMP Router Discovery [4], among the Router Addresses specified above. In any case, a mobile mode registered via a foreign agent MAY choose its foreign agent as a default router.	4), s a		gent mus atagrams ile node e datagr
	Note that Van Jacobson header coproperly unless all TCP IP datagness, respectively, through the smobile node, therefore, MUST sell router if it performs Van Jacobs foreign agent.	Note that Van Jacobson header compression [10] will not function properly unless all TCP 1P datagrams to and from the mobile node pass. respectively, through the same first and last-hop router. The mobile node, therefore, MUST select its foreign agent as its default fouter if it performs Van Jacobson header compression with its foreign agent.	رد ه	ူက္သံ ။ စုရင္မ	lity of mult beach care- lf the mobi WUST NOT att. and thus wil home agent le that it w
3164 3165 3165 3167 3169 3170 3171 3172 3173	Upon receipt of an encarders, a for address, a for address to those entriduces not match the address not match the fore modifications to the o loop is likely to resu ICMP Destination Unreasumable to forward an inforeign agent forwards	Upon receipt of an encapsulated datagram sent to its advertised care-of address, a foreign agent MAST compare the inner destination address to those entries in its visitor list. When the destination does not match the address of any mobile node currently in the visitor list, the foreign agent MAST NOT forward the datagram without modifications to the original IP header, because otherwise a routing loop is likely to result. The datagram SHOULD be silently discarded. The Destination Ubreachable MUST NOT be sent when a foreign agent is unable to forward an incoming tunneled datagram. Otherwise, the foreign agent forwards the decapsulated datagram to the mobile node.	uut uut sg. is	home home the Year of the Year of the Year of the Control of the Year of the Control of the Year of the Control of the Year of the Control of the Year of the Control of the Year of the Manager of the Year of the Manager of the Manager of the Year of The Year	is at home and network.  Section 4.1 required in Noger returned is off signer returned in riginal sender agents SHOULD agents Steed to themse sissed to themse an ining locatic.
3176 3177 3178 3178 3180 3181 3182 3183 3184 3185	The foreign agent MUST downin, nor to any oth (Section 4.5).  The foreign agent MUST mobile nodes. At a min verify the IP Header Cl recompute the IP Header default router. In adaptropriate ICMP Redire	The foreign agent MUST NOT advertise to other routers in its routing domain, nor to any other mobile node, the presence of a mobile router (Section 4.5).  The foreign agent MUST route datagrams it receives from registered mobile nodes. At a minimum, this means that the foreign agent must recompute the IP Header Checksum, decrement the IP Time To Live, recompute the IP Header Checksum, and forward such datagrams to a default router. In addition, the foreign agent SHOULD send an appropriate ICMP Redirect message to the mobile node.	ig er		itime foreceived that bithat bithat bithat bithat MUS: mobile it of the probable when delete multane
3187 3188 3190 3190 3191 3193 3194 P	Perkins	Standards Track [Page 57]		3242 node. 3243 node. 3244 When a home agent r 3245 mobile nodes regist 3246 the datagram to che 3247 3249 3250 Perkins	agent s regis m to ch

Page 58					
	October 1996	atagrams on the home mobile node is us ARP MAY be used in ction 4.6.	Address of all for the home address of any I so, the home agent ently registered carepports the optional indings, it tunnels a e's mobility bindings, the home destined for the mobile hadagrams. However, muon IP traffic, it is or forwarding onto the ST assume the mobile a directly onto the	SHOULD also implement allows ICMP error in allows ICMP error iy be reflected back to is.  If further deliver packets for the purpose of Section 5.5.  expires before the home acquest for that mobile obblity binding list.  Request for that mobile obblity binding list.  Reply message simply in the eliventy in the eliventy in the eliventy in the eliventy in the eliventy in the me expires, the home me expires, the home me expires, the home tain any other (non-till holds for the mobile	intercepted for one of its the home agent MNST examine encapsulated. If so, special k
rfc2002.txt	IP Mobility Support	The home agent MUST be able to intercept any datagrams on the home network addressed to the mobile node while the mobile node is registered away from home. Proxy and gratuitous ARP MAY be used in enabling this interception, as specified in Section 4.6.	The home agent must examine the IP Destination Address of all arriving datagrams to see if it is equal to the home address of any of its mobile nodes registered away from home. If so, the home agent tunnels the datagram to the mobile node's currently registered carecapability of multiple simultaneous mobility bindings, it tunnels a copy to each care-of address in the mobile node's mobility bindings, it tunnels a list. If the mobile node has no current mobility bindings, the home agent MUST NOT attempt to intercept datagrams destined for the mobile node, and thus will not in general receive such datagrams. However, if the home agent is also a router handling common IP traffic, it is home network. In this case, the home agent MUST assume the mobile node is at home and simply forward the datagram directly onto the home network.	See Section 4.1 regarding methods of encapsulation that may be used for tunneling. Nodes implementing Ytunneling SHOULD also implement the 'tunnel soft state" mechanism [14], which allows ICMP error messages returned from the tunnel to correctly be reflected back to the original senders of the tunneled datagrams.  Home agents SHOULD be able to decapsulate and further deliver packets addressed to themselves, sent by a mobile node for the purpose of maintaining location privacy, as described in Section 5.5.  If the Lifetime for a given mobility binding expires before the home agent has received another valid Registration Request for that mobile node, then that binding is deleted from the mobility binding list. The home agent MUST NOT send any Registration Reply message simply because the mobile node's binding has expired. The entry in the auturally, probably at the same time as the binding expired at the nome agent. When a mobility binding's lifetime expired, the home agent MUST delete the binding, but it MUST retain any other (nonnode.	ives a datagram, intercepted fi l away from home, the home agen if it is already encapsulated. Standards Track
May 13 1998 10:38:26	RFC 2002	4.2.3. Home Agent Considerations The home agent MUST be able t network addressed to the mobi registered away from home. P enabling this interception, a	The home agent must exarriving datagrams to of its mobile nodes returnels the datagram to daddress or addresse capability of multiple copy to each care-of a list. If the mobile node, and thus will not if the home agent is a jossible that it will home network. In this node is at home and si home network.	See Section 4.1 regard for tunneling. Nodes the 'tunnel soft state messages returned from the original senders o Home agents SHOULD be addressed to themselve maintaining location p If the Lifetime for a gent has received and node, then that binding. The home agent MUST NOT because the mobile nod visitor list of the mol naturally, probably at home agent. When a mol agent MUST delete the pexpired) simultaneous node.	When a home agent receives a datagram, imobile nodes registered away from home, the datagram to check if it is already effectins  Standards Track
May	3195 3196 3197	3200 3200 3200 3202 3203 3204	3205 3206 3206 3208 3208 3210 3211 3211 3211 3211 3218 3218 3218	3222 3223 3224 3225 3226 3227 3229 3239 3239 3239 3236 3236 3237 3236 3237 3236 3237 3237	

13 188	May 13 1998 10:38:26	rc2002.txt		Page 59
RFC 2002		IP Mobility Support	October 1996	
9	apply in the	rules apply in the forwarding of that datagram to the mobile node	the mobile node:	
- 10	f the inner (er	If the inner (encapsulated) Destination Address is the same	ss is the same	
_= 3	ome agent MUST	also examine the outer Source	Address of the	
ن ر	his outer Source	this outer Source Address is the same as the mobile node's	the tunnel). If mobile node's	
ני ט	urrent care-of hat datamram in	address, the home agent MUST	silently discard	
	nstead, the out	instead, the outer Source Address is NOT the same as the mobile	uting toop. If, same as the mobile	
ت =	orward the data	node's current care-of address, then the home agent SHOULD forward the datagram to the mobile node. In order to four	home agent SHOULD In order to formed	
₽ 3	he datagram in	the datagram in this case, the home agent MAY simply alter the	simply alter the	
Ę	re-encapsulating the datagram.	restrictions and test to the care-of address, rather than re-encapsulating the datagram.	ess, rather than	
ō	therwise (the i	Otherwise (the inner Destination Address is now the	;	
ē	uter Destinatio	on Address), the home agent SHG	of the same as the DULD encapsulate	
غ تــ	he datagram aga	in (recursive encapsulation),	with the new outer	
್ ಕ	ddress. That i	pestination Addiess set equal to the mobile node's care-of address. That is, the home agent forwards the entire datagram	ode's care-of	
ŭ.	o the mobile no	de in the same way as any other	er datagram	
ے	(encapsulated already or not).	ready or not).		
Broi	Broadcast Datagrams	21		
en !	a hom <b>e</b> agent re	When a home agent receives a broadcast datagram, it Mism Nom formard	T MIICE NOT FORMER	
٠ ا	atagram to any	the datagram to any mobile nodes in its mobility binding list other	inding list other	
an bi Le	than those that have mobile node MAY rema	have requested forwarding of broadcast datagr	lcast datagrams. A	
	9 bit in its R	the 'B' bit in its Registration Request message (Section 3.3).	leagrams by setting Section 3.3), For	
<del>.</del> .	such registered	each such registered mobile node, the home agent SHOULD forward	HOULD forward	
re.	r of configurat	ideagrams to the mobile node, a lon at the home agent as to wh	ilthough it is a	
egc	ories of broadc	categories of broadcast datagrams will be forwarded to such mobile	d to such mobile	
nodes.				
if the	e 'D' bit was s	the 'D' bit was set in the mobile node's Registration Remiest	ration Remissr	
SSAC	Je, indicating	message, indicating that the mobile node is using a co-located care-	a co-located care-	
1 To	datagrams to the mobile nod	agent simply tunnels appropriate broadcast IP	ate broadcast IP	
**	is NOT set), th	hit was NOT set), the home agent first encapsulates the broadcast	s the broadcast	
iag.	am in a unicas	t datagram addressed to the mo	bile node's home	
agent.	rs, and then tu This extra	This extra level of encapsulation is remited at the forei	am to the foreign	
eig	ın agent can de	foreign agent can determine which mobile node should receive the	ld receive the	
datayra agent,	am atter it is the unicast e	is decapsulated. When received by the foreign	by the foreign	
			erea alla detivered	-
Perkins		Standards Track	(Page 59)	

Ma	May 13 1998 10:38:26	rfc2002.txt		Page 60
3307 3308 3309	RFC 2002	IP Mobility Support	October 1996	
3310 3311 3312 3313 3313	to the case, order	mobile node in the same way as any other datagram. In eithe the mobile node must decapsulate the datagram it receives in to recover the original broadcast datagram.	ram. In either t receives in	
3315	4.4. Multicast Datagram Routing	m Routing		
3317		a mobile r	ted to its home	
3319		router. Thus, when it is at home, a mobile node functions identically to other multicast senders and receivers. This	tions This section	
3321		therefore describes the behavior of a mobile node that is visiting a foreign network.	t is visiting a	
3324		In order receive multicasts, a mobile node MUST join the multicast	the multicast	
3326		group in one of two ways. First, a mobile node MAY join the grovia a (local) multicast router on the visited subnet. This ort	oin the group	
3327		is a multicast router present on t		
3329	SHOULD u	SHOULD use this address as the source IP address, of its IGMP [5]	e-ot address, it ts IGMP [5]	
3331	*	יייייייייייייייייייייייייייייייייייייי		
3333	u	olle node which wishes to receive ri-directional tunnel to its home a	nulticasts MAY	
3334		that its home agent is a multicast router. The mobile node tunnels	node tunnels	
3336		datagrams down the tunnel to the mobile node. The rules for	rwards multicast les for	
3338		delivery to mobile nodes in this control broadcast date and a second date and a seco	ise are	
3339		the mobile node is using a co-located care-of address (the 'D' bit	(the 'D' bit	
3341		was set in the mobile node's Registration Request), then the home	ien the home	
3342		the home agent MUST first encapsulate the datagram in a unicast	ess; otnerwise, a unicast	
3344		the reculting determined to the mobile node's home address a	and then MUST	
3345	node's	cagram (recursive cumering)	to the mobile	
3347		the contraction of particular of particular of the contraction of the		
3348		has two options: (1) send directly on the visited network; or (2)	.cast group also .work; or (2)	
3350		its home agent. Because multicas	t routing in	
3351		ithe IP Source address, a mobile r directly on the visited network M	ode which sends	
3352		ess as the 1P source address. Sin	nilarly, a	
3354		mobile node which tunnels a multicast datagram to its home agent MUST	home agent MUST	
3355		multicast datagram and the (outer) encapsulating datagram.	the (inner) ram. This	
3356		s that the home agent is a multicast router.	ಸ	
3358			•	
3360				
3362	Perkins	Standards Track	(09 oped)	
			leage on	
	-			

May 13 1998 10:38:26	3419 3420 RFC 2002 3421	3422 e) The aircra 3424 intercepts 3425 address, w 3426 ground beli 3427 correspond 3429 agent.	3431 f) The foreign 3432 yielding a 3433 agent, with 3434 address of 3435 dategram or	(6)	3443 This example illust 3444 to a mobile network 3445 to the network, whi 3446 ground). If, instel 3448 network (the mobile 3449 correspondent nodes 3450 A home agent MAY be 3452 the fixed node, the 3453 fixed host; s care-c		4.6	1466 The use of ARP [16] 3467 wireless or mobile 3468 this section apply 3470 address resolution. 3471 3472 3473 . 3474 Perkins	
Page 61									
rfc2002.txt	Support October 1996	h is responsible for the mobility ng together, perhaps on an obile, a bicycle, or a kayak. The by the mobile router may nodes or routers. In this "mobile networks".	n agent and provide a foreign es connected to the mobile le node via a mobile router in lowing example:	A laptop computer is disconnected from its home network and later attached to a network port in the seat back of an aircraft. The laptop computer uses Mobile IP to register on this Coreign network, using a foreign agent care-of address discovered through an Agent Advertisement from the aircraft's foreign agent.	The aircraft network is itself mobile. Suppose the node serving as the foreign agent on the aircraft also serves as the default router that connects the aircraft network to the rest of the Internet. When the aircraft is at home, this router is attached to some fixed network at the airline's headquarters, which is the router's home network. While the aircraft is in flight, this router registers from time to time over its radio link with a series of foreign agents below it on the ground. This router's home agent is a node on the fixed network at the airline's headquarters.	Some correspondent node sends a datagram to the laptop computer, addressing the datagram to the laptop's home address. This datagram is initially routed to the laptop's home network.	The laptop's home agent intercepts the datagram on the home network and tunnels it to the laptop's care-of address, which in this example is an address of the node serving as router and foreign agent on the aircraft. Normal IP routing will route the datagram to the fixed network at the airline's headquarters.	rack [Paye 61]	
May 13 1998 10:38:26 rfc	RFC 2002 IP Mobility Support	4.5. Mobile Routers  A mobile node can be a router, which is responsible for the mobility of one or more entire networks moving together, perhaps on an airplant, a ship, a train, an automobile, a bicycle, or a kayak. The index connected to a network served by the mobile router may themselves he fixed nodes or mobile nodes or routers. In this document, such networks are called "mobile networks".	A mobile router MAY act as a foreign agent and provide a foreign agent care-of address to mobile nodes connected to the mobile network. Typical routing to a mobile node via a mobile router in this case is illustrated by the following example:	a) A laptop computer is discondater attached to a network aircraft. The laptop computinis foreign network, using discovered through an Agent foreign agent.	h) The aircraft network is itself mobile. Suppose the serving as the foreign agent on the aircraft also such ediault router that connects the aircraft networsty of the Internet. When the aircraft is at home router is attached to some fixed network at the air headquarters, which is the router's home network. The aircraft is in flight, this router registers from to time over its radio link with a series of foreignelow it on the ground. This router's home agent is on the fixed network at the airline's headquarters.	c) Some correspondent node sends a datagram to the laptop computer, addressing the datagram to the laptop's home address. This datagram is initially routed to the lapt home network.	d) The laptop's home agent intententententententententententententen	Perkins Standards Track	·
May 1		3368 3368 3370 3370 3373 3373 3374	3376 3377 3378 3378 3380	3381 3382 3384 3386 3386	13188 13189 131990 131992 131996 131996 131996	3399 3400 3401 3402 3403	3404 3405 3406 3407 3409 3410	3411 3412 3413 3414 3415 3417 3418 Pe	

Ma	y 13 1	866	May 13 1998 10:38:26 rfc2002.txt	Page	62
3419 3420 3421	RFC	2002	02 IP Mobility Support	October 1996	
3 4 4 2 2 2 3 3 4 4 4 2 2 2 3 4 4 2 2 2 2		ê	The aircraft router and foreign agent's home intercepts the datagram and tunnels it to its address, which in this example is some foreign ground below the aircraft. The original data correspondent node has now been encapsulated by the laptop's home agent and again by the agent.	agent there current care-of n agent on the gram from the twice: once ircraft's home	
34432 34433 3433 3433 3433		f)	The foreign agent on the ground decapsula yielding a datagram still encapsulated by agent, with a destination address of the address. The ground foreign agent sends datagram over its radio link to the aircr	ites the datagram, the laptop's home laptop's care-of the resulting aft.	
34437 34440 34440		g)	y) The foreign agent on the aircraft decapsulates the datagram, yielding the original datagram from the correspondent node, with a destination address of the laptop's home address. The aircraft foreign agent delivers the datagram over the aircraft network to the laptop's link-layer address.	s the datagram, spondent node, me address. Tram over the ddress.	-
3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	Th: to to grc net eit	is es a mc the ound) twork ther	This example illustrated the case in which a mobile node is attached to a mobile network. That is, the mobile node is mobile with respect to the network, which itself is also mobile (here with respect to the ground). If, instead, the node is fixed with respect to the mobile network (the mobile network is the fixed node's home network), then either of two methods may be used to cause datagrams from correspondent nodes to be routed to the fixed node.	ode is attached le with respect h respect to the to the mobile hetwork), then	<u> </u>
3455 3455 3455 3455 3455 3455 3455	the fix usu for for fix	home e fix ked h nally r adv ked n	A home agent MAY be configured to have a permanent registration for the fixed node, that indicates the mobile router's address as the fixed host's care-of address. The mobile router's home agent will usually be used for this purpose. The home agent is then responsible for advertising connectivity using normal routing protocols to the fixed node. Any datagrams sent to the fixed node will thus use recursive tunneling as described above.	fistration for fress as the ne agent will then responsible cocols to the ithus use	
3 3 4 4 5 5 6 5 6 5 6 5 6 5 6 5 6 5 6 5 6 5	Alter entir bi-di need 4.6. ARF	cire dire ed fo	Alternatively, the mobile router MAY advertise connectivity to the entire mobile network using normal IP routing protocols through a bi-directional tunnel to its own home agent. This method avoids the need for recursive tunneling of datagrams.	ivity to the s through a hod avoids the	
34466 34466 34466 34470 3471	The wir thi add	use reles s se ress	The use of ARP [16] requires special rules for correct operation when wireless or mobile nodes are involved. The requirements specified in this section apply to all home networks in which ARP is used for address resolution.	operation when trs specified in s used for	··
347.74	Perkins	٠٠ 	Standards Track	Page 62	

l º	-																											
	October 1996	sters a binding on RP to update the	es such nodes to with the mobile ng for a mobile ding (the mobile	T transmit a gratuitous ARP the link on which	roadcasts on the ranteed to be	nsmitted a small	mobile node nodes on the	es to once again with the mobile	(de)Registration MUST transmit this	cast on this link, small number of	smissions SHOULD ssing of its	this	cransmit a This gratuitous	e address with	ent, since in the n transmission	at within range agent MUST be	s nome link, to increase ULD proceed in	(de) Registration	transmit any	y, while the ARP Requests	ess, unless the mobile node lich the mobile	In the latter case, the mobile		[Page 64]				
rfc2002.txt	IP Mobility Support	aves its home network and regist home agent uses gratuitous A	associate the link-layer dadress of the home agent with the mobile node's home (IP) address. When registering a binding for a mobile node for which the home agent previously had no binding (the mobile	e at nome), the home agent MUS alf of the mobile node. This itted as a broadcast packet on	the mobile node's home address is located. Since broadcasts on the local link (such as Ethernet) are typically not guaranteed to be refliable. The gratuit and such a count is	number of times to increase its reliability.	When a mobile node returns to its home network, the mobile node and its home agent use gratuitous ARP to cause all nodes on the	mobile nuck's home network to update their ARP caches to once again associate the mobile node's own link-layer address with the mobile node's home its address with the mobile.	s home agent, the mobile node	nome network as a local broad sket SHOULD be retransmitted a	reliability, but these retran; ith the transmission and proce: est.	When the mobile node's home agent receives and accents this	(de)Registration Request, the home agent MUST also transmit a gratuitous ARP on the mobile node's home network. This gratuitous	ssociate the mobile node's home link-layer address. A gratuit	le mobile node and its home age	cauge of the mobile hode will likely differ from that within range of its its home agent. Thin RP packet from the home agent MUST be transmitted as a lovel broadcast on the test of the most of the most of the control by the most of the control by	and SHOULD be retransmitted a small number of times to increase its reliability; these retransmissions, however. SHOULD mornered	parallel with the transmission and processing of its (de)Registration Reply.	While the mobile node is away from home, it MUST NOT transmit any broadcast ARP Recuest or ARP Remiy macagan	om home, it MUST NOT reply to address is its own home addres	ARP Request is sent by a foreign agent with which the mobile node is attempting to register or a foreign agent with which the mobile	registration. In the latter c		Standards Track				
May 13 1998 10:38:26	3531 3532 RFC 2002			542 gratuitous ARP on behe 543 packet MUST be transmi	545 the mobile node's home 545 local link (such as Et 546 reliable, the gratuits	•		1551 mobile node's home net 1552 associate the mobile n 1553 node's home (10)																o reikins		w	-	
	3531		3538		A GA GA	32.50	326		35.	35.6	20.00	3560	3563	3565	3567	3569	357	357	3576	357	3580	3583	3585	-			_	
ဗွ	Ī													-					_						<del></del> -			
Page 63							a															~						
✓ rfc2002.txt	1P Mobility Support October 1996	In addition to the normal use of ARP for resolving a target node's link-layer address from its IP address, this document distinguishes two special uses of ARP:	A Proxy ARP [18] is an ARP Reply sent by one node on behalf of another node which is either unable or unwilling to answer its own ARP Requests. The sender of a Proxy ARP reverses the	Sunder and Target Protocol Address fields as described in [16], but supplies some configured link-layer address (generally, its own) in the Sender Hardware Address field. The node receiving	the Reply will then associate this link-layer address with the IP address of the original target node, causing it to transmit	incure datagrams for this target node to the node with that link-layer address.	A Gratuitous ARP [23] is an ARP packet sent by a node in order to spuntameously cause other nodes to update an entry in their ARP		and ARP Target Protocol Address are both set to the IP address of the cache entry to be updated, and the ARP Sender Hardware	Address is set to the link-layer address to which this cache entry should be updated. When using an ARP Reply packet, the	Target Hardware Address is also set to the link-layer address to which this cache entry should be updated (this field is not used in an ARP Remnest nacket)	for a grafuitone abb the abs modes with	transmitted as a local broadcast make in the parket must be specified in [16], any node receiving any APP market (because of	date its local ARP cache with the Sender Protocol ddresses in the ARP backet, if the rereiving mode	has an entry for that IP address already in its ARP cache. This requirement in the ARP protocol applies even for ARP Remiest	packets, and for ARP Reply packets that do not match any ARP Request transmitted by the receiving node [16].	s registered on a foreign network, its home [18] to reply to ARP Remosts it received that	Ink-layer address. When receiving an ARP of MUST examine the target IP address of the	Kequesc, and it this IP address matches the home address of any mobile mode for which it has a registered mobility binding, the home address MRST transmit as an expensive the home mobility binding, the home	and target addresses in the packet [18], the	the link-layer address of its own interface over which the Reply will be sent.		Standards Track     Page 63					
May 13 1998 10:38:26	PPC 2002	In addition to the norma link-layer address from two special uses of ARP;	of another node	Sender and Targ but supplies so own) in the Ser	the Reply will IP address of t	inchre datagrams to link-layer address.	- A Gratuitous AR spontaneously o	cache. A gratu Reply packet.	and ARP Target of the cache en	Address is set entry should be	Target Hardware Address is which this cache entry sho in an ARP Request packet)	In either case.	transmitted as specified in [1	Reply) MUST upd and Hardware Ad	has an entry fo requirement in	packets, and fo Request transmi	While a mobile node is agent uses proxy ARP [	seek the mobile node's Request, the home agen	Request, and if this I mobile node for which adent MUST transmit an	exchanging the sender home agent the	the link-layer address be sent.		Perkins					

Page 64

May 13 1998 10:38:26	3643 3644 RFC 2002	3645 3646 - Before transmitt 3647 - Re-enables its or 3649 subsequently rec	1 1		3664 3664 3665 The mobile computing 3665 the ordinary computing 3667 will be connected to 3668 particularly vulneral	5.1	3679 PLEIXFRIIX mode, 3679 with manual key distr 3680 algorithm modes, key 3681 supported. 3682 5.2. Areas of Security C 3684 The redistration modes 3685		3697 3698 Perkins
Page 65	,								
May 13 1998 10:38:26 rfc2002.txt	RFC 3002 IP Mobility Support October 1996	node MUST use a unicast ARP Reply to respond to the foreign agent. Hote that if the mobile node is using a co-located care-of address and receives an ARP Request in which the traget IP address is this care-of address, then the mothle node cumin and the contractions.	Request. Note also that whom transmitting a Registration Request on a foreign network, a mobile node may discover the link-layer address on of a foreign agent by storing the address as it is received from the Adject Advertisement from that foreign agent, but not by transmitting a broadcast ARP Request message	The specific order in which each of the above requirements for the use of ARP, proxy ARP, and gratuitous ARP are applied, relative to the transmission and processing of the mobile node's Registration Request and Registration Reply messages when leaving home or returning home, are important to the correct operation of the protocol.	To summarize the above requirements, when a mobile node leaves its home network, the following steps, in this order, MUST be performed:  - The mobile node decides to register away from home, perhaps because it has received an Agent Advertisement from a foreign agent and has not recently received one from its home agent.	- Before transmitting the Registration Request, the mobile node disables its own future processing of any ARP Requests it may subsequently receive requesting the link-layer address corresponding to its home address, except insofar as necessary to communicate with foreign agents on visited networks.	When the mobile node's home agent receives and accepts the Registration Request, it performs a gratuitous ARP on behalf of the mobile node, and begins using proxy ARP to reply to ARP Requests that it receives requesting the mobile node's link-layer address. If, instead, the home agent rejects the Registration Request, no ARP processing (gratuitous nor proxy) is performed by the home agent.	When a mobile node later returns to its home network, the following steps. in this order, MUST be performed: - The mobile node decides to register at home, perhaps because it has received an Agent Advertisement from its home agent.	Perkins Standards Track [Page 65]
May		3590 3591 3592 3593 3594	3595 3596 3597 3598 3599	3600 3601 3602 3603 3603 3604 3606	3608 3609 3610 3611 3612	3615 3615 3617 3618 3620 3621	3623 3623 3625 3625 3627 3628 3629	2000 2000 2000 2000 2000 2000 2000 200	3642 Pe

Page 66	1996		is	M C
	October 19	sst, the mobile node by ARP Requests it may ayer address. for itself.	and accepts the ARP to reply to he mobile node's activitious ARP on behal agent rejects the ratuitous nor proxy)	Tenically very different from from many cases, mobile computers witeless links. Such links are seafcopping, active replay state of 128 bits. It with a key size of 128 bits. It with a key size of 128 bits. It will also support in MUST also support in MUST also support in themtication algorithms, themtication algorithms, lods, and key sizes MAY also be oits care-of address. This not vulnerability if the Such remote redirection, for gistration protocol, is widely the current Internet if not ess Resolution Protocol is widely in be used to steal another sa ARP (Section 4.6) brings the the use of ARP.
rfc2002.txt	IP Mobility Support	Before transmitting the Registration Request, the mobile re-enables its own future processing of any ARP Requests subsequently receive requesting its link-layer address. The mobile node performs a gratuitous ARP for itself	The mobile node transmits its Registration Request.  When the mobile node's home agent receives and accepts the Registration Request, it stops using proxy ARP to reply to ARP Requests that it receives requesting the mobile node's link-layer address, and then performs a gratuiturus ARP on behalf of the mobile node. If, instead, the home agent rejects the Registration Request, no ARP processing (gratuitous nor proxy) is performed by the home agent.  rity Considerations	nt is po ment. In the via w sive eave cks.  WIST be al MIDS [21] is to bold is to hore aud form methe in methed to in methed to meled to spile reg bolle reg bolle reg bolle reg cated in active cated in active cated in active and meled to meled to
May 13 1998 10:38:26	RFC 2002	Before transmittin re-enables its own subsequently receir The mobile node pe	- The mobile node tra - When the mobile nod Registration Request ARP Requests that i link-layer address, of the mobile node. Registration Request performed by the ho 5. Security Considerations The mobile computing en	The modulating environment is potential the ordinary computing environment. In many will be connected to the network via wireless particularly vulnerable to passive eavesdrog attacks, and other active attacks.  5.1. Message Authentication Codes  Home agents and mobile nodes NUST be able to The default algorithm is keyed MD5 [21], with default and pointing its keyed MD5 [21], with default and pointing its keyed MD5 [21], with default and one of operation is to both preto be hashed, by the 128-bit key; that is, "prefix-suffix mode. The foreign agent MUS authentication using keyed MD5 and key sizes with manual key distribution. More authentic supported.  5.2. Areas of Security Concern in this Protocol The registration were not authenticated. Such viringstration were not authenticated. Such virinstance as performed by the mobile registra understood to be a security problem in the cauthenticated [2]. Moreover, the Address Reposits is not authenticated and can potentially behost's traffic. The use of "Gratuitous ARPWith it all of the risks associated with the with it all of the risks associated with the cauthenticated.
May	3644 3644 3645	3652 3652 3652 3652 3652	3655 3655 3655 3655 3661 36662 36663	

May 13			Perki
Ma	3755 3756 3757 3757	3759 3760 3760 3760 3760 3767 3767 3768 3776 3776 3776 3777 3777	0
Page 67			
	October 1996	saction mechanism (keyed assed on the Mobile IP listribution is gagement protocol, equired to be I might be important to agent and the home re providers do not respectively. This specification rithms and modes. For this specification, but does not the ey aspecification with sand modes. For this specification is and pseudo-random. For they must for any others to see a document (such as a document (such as a document (such as a document (such as a document (such as a document (such as a document (such as a document (such as uber and in may be unbite node and create a thing for correspondent work, and it may be cument.	Co p551
rfc2002.txt	IP Mobility Support	strong authentication and all and all and all and are not all required are not all required are not all required are not all required are not all required and service properties and service properties and service properties and service properties and service properties and service properties and service properties are not legitimate cuts implication algorithms serviced NDS for authentication algorithms are not legitimate of authorized parties) to with replay protection with replay protection with replay protection with replay protection with replay protection with replay protection with replay protection with replay protection. Use a Gesired, the mobile for appropriate use of a Gesired, the mobile in, datagrams destined from the home network, i location of the mobile scope of this documents.	
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ğ	3699 3700 3702 3702	3704 3705 3706 3706 3706 3716 3716 3717 3718	

Ma	May 13 1998 10:38:26	rfc2002.txt	Page 68	
3755 3756 3757	FFC 2002 IP N	IP Mobility Support	1996	I
3758	5.6. Replay Protection for Registration Requests	istration Requests		
3761	The Identification field is	is used to let the home agent verify that	hat a	_
3763	not replayed by an attacker	registration message has been treshly generated by the mobile node, to replayed by an attacker from some previous registration. Two	iode, wo	
3765	methods are described in the "nonces" (optional). All m	is section: timestamps (mandatory) obile nodes and home agents MUST imp	and Lement	
3767	timestamp-based replay prot nonce-based replay protecti	timestamp-based replay protection. These nodes MAY also implement nonce-based replay protection (but see Appendix A.2 for a patent that	ent t that	
3769	may apply to nonce-based re	play protection).		
3770	The style of replay protect	The style of replay protection in effect between a mobile node and	and	
3772	node and its home agent MUS	ne mobile security association: A m T agree on which method of replay	A mobile	
3773	protection will be used. I field depends on the method	protection will be used. The interpretation of the Identification field depends on the method of replay protection as described in the	ion n rhe	
3775	subsequent subsections.			_
3777	Whatever method is used, th	e low-order 32 bits of the Identific	ation	_
3779	rost ne copied unchanged in The foreign agent uses thos	om the Registration Request to the R e bits (and the mobile node's home	eply.	_
3780 3781	address) to match Registrat The mobile node MUST verify	address) to match Registration Requests with corresponding replies. The mobile node MIST verify that the locations is the	ies.	-
3782	Registration Reply are iden	tical to the bits it sent in the		
3784	יייי שלמכפריי שלמכפריי			_
3785	The Identification in a new as in an immediately preced	Registration Request MUST NOT be th	e same	_
3787	the same security context i	the same security context is being used between the mobile node and	nile and	_
3789	the home agent. Retransmis	sion as in Section 3.6.3 is allowed.		
3790 3791	5.6.1. Replay Protection using Timestamps	Timestamps		
3792	The basic principle of time	stamp replay protection is that the	node	_
3794	generating a message insert receiving the message check	generating a message inserts the current time of day, and the node receiving the message checks that this timestamm is enfitionally	ode	
3795	close to its own time of da	7. Obviously the two nodes must have	~ m	
3797	adequately synchronized tim time synchronization messad	adequately synchronized time-of-day clocks. As with any message time synchronization messages may be profected anainst temporial	es,	
3798 3799	an authentication mechanism determined by between the two nodes	determined by the security context	λα f	
3800				
3802	ir timestamps are used, the field to a 64-bit value for	II timestamps are used, the mobile node MUST set the Identification field to a 64-bit value formatted as specified by the Motunet mime	cion	
3803	Protocol [13]. The low-ord	or 32 bits of the NTP format represen	וווי זר	
3805	tractional seconds, and those bits which are	se bits which are not available from ited from a good source of randomness	e ;	
3806 3807	Note, however, that when us	ing timestamps, the 64-bit Identification	tion	
3808				
3810	Perkins Sta	Standards Track [Pag	[Page 68]	

Support October 1996 ation Request message into the trion in the Registration Reply. In the Registration Reply order 32 bits of the sorder 32 bits of the sorder 32 bits of its next generating the low-order 32 bits firstion Request. Ideally it es. However it may use any tion of the random value sent by their of the random value sent by list of the random value sin the and low-order 32 bits of the lifter from their previous values. If you have the mobile node uses a ration message. The foreign agent obbile host's home address) to	is rejected because of an invalid nonce, the mobile node with a new nonce to be used Thus the nonce protocol is self-	Page 70
rom the Registration the Identification receives an authent it saves the high-order se as the high-order on in each Registration in each Registration and monces. Cluding duplication method chosen is on the node that check. The high-order and in SHOULD both differ an en whigh-order value and whigh-order value and whigh-order value and whigh-order value and whigh-order value and high-order value for each registration replies will stration replies will		Standards Track
R	If a registration message the Reply always provides in the next registration. synchronizing.	Perkins :
3866 3869 3872 3872 3872 3874 3874 3876 3887 3887 3888 3888 3888 3888 3888	28921 18921 18922 18922 18922 18922 18922 18922 18922 18922 18922 18922 18922 18922 18922 18922 18922 18923 18923 18923 18923 18923 18923 18923 18923 18923 18923 18933	3921 3922 3922

Page 70

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e 71		
t Page	along with Dan Duchamp, its early development.  I, and Tony Li for their he duties of comments.  'Working Group, uding (in alphabetical tr. reflecting the enew text of this memo Qualcomm), and Frank support in hosting	. (Page 71)
rfc2002.txt	Acknowledgments  Special thanks to Steve Deering (Xerox PARC), along with Dan Duchamp and John loannidis (JI) (Columbia), for forming the working group, chairing it, and putting so much effort into its early development. Thanks also to Kannan Alaggapan, Greg Minshall, and Tony Li for their chair person, as well as for their many useful comments.  Thanks also to Kannan Alaggapan, Greg Minshall, and Tony Li for their chairperson, as well as for their many useful comments.  Thanks to the active members of the Mobile IP Working Group, particularly those who contributed text, including (in alphabetical order)  - Ran Atkinson (Rarnege Mellon University), - Tank Kastenholz (FTP Software), - Andrew Wyles (Macquarie University), - Frank Kastenholz (FTP Software), - Andrew Wyles (Macquarie University), - Andrew Wyles (Macquarie University), - Andrew Wyles (Songarie University), - Andrew Wyles (Songarie University), - Thom Thanks to Charlie Kunzinger and to Bill Simpson, the editors who discussions of the Working Group. Much of the new text of this memo is due to Jim Solomon and Dave Johnson.  Thanks to Greg Minshall (Novell), Phil Karn (Qualcomm), and Frank Kastenholz (FTP Software) for their generous support in hosting interim Working Group meetings.	Standards Track
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Ma	ay 13	1998 10	May 13 1998 10:38:26	rfc2002.txt		Page 72
3979 3980 3981	RFC	2002	<b>H</b>	IP Mobility Support	October 1996	:
3982	4	Patent Issues	sanss			
3985		As of the patents t described	the time of publication, s that may be relevant to bed in this technical sp	As of the time of publication, the IETF had been made aware of patents that may be relevant to implementors of the protocol described in this technical specification.	e aware of two protocol	
3989	A.1	IBM Pat	. IBM Patent #5,159,592			
3991 3992		Charles F No. 5,159	Perkins, editor of this memo, 9,592, assigned to IBM. In a	of this memo, is sole invent. to IBM. In a letter dated M	or of U.S. Patent	
3993 3994		rought t	this patent to the More	brought this patent to the attention of the IETF, stating that this patent "relates to the Mobile IP." We understand that TRM did not	ating that this	
3995 3996		ntend to	o assert that any would not infrir	intend to assert that any particular implementation of Mobile I would or would not infringe the parent but rather that the way	of Mobile IP	
3997		meeting what be relevant t	what it viewed as and to the process	it viewed as a duty to disclose information that to the process of adopting a standard.	tion that could	
4000		Based on		a review of the claims of the patent. IETE helieves that	nelieves that a	
4001		system of described	f registering and in the document	registering an address obtained from a foreign agent, a	eign agent, as	
4003		claims of	f the patent; and	d that a system in which an a	tinge any or the address is	
4005		ecessari	ersewnere and the ily infringing and	n be impl patent.	lemented without	
4006		iew is t ecessari	that the proposed ily infringing th	~	d without	
4008		-				
4009 4010 4011 4011		arties c pecific nfringin espect t	considering adopt implementations, ng implementation	Parties considering adopting this protocol must be aware that some specific implementations, or features added to otherwise non-infringing implementations, may raise an issue of infringement with respect to this patch or to some other parts.	ware that some wise non- fringement with	
4013	Ē	הומ מדמד	femont is for the			
4015 4016 4017	0.0.0	rocedure r guaran	e, and should not ing ad by the Derkins	procedure, and should not be relied upon by any party as an opinion or guarantee that any implementation it might make or use would not be convered by the backling beauty and the conversed by the party implementation it might make or use would not be conversed by the party implementation it might make or use would not	dindard-secting  As an opinion  use would not	
4018	ಾಗ್	articula escribed	ar, IBM might dis d herein.	racent and any other patent agree with the interpretatio	s. In on of this patent	
4020	A. 2	IBM Pat	. IBM Patent #5,148,479			
4024 4024 4025 4026 4027		This patent, als implement nonce 5.6.2. Note this feature of this the other hand,	This patent, also assigned to implement nonce-based replay profes. Note that nonce-based feature of this specification. the other hand, (Section 5.6.1)	This patent, also assigned to IBM, may be relevant to those who implement nonce-based replay protection as described in Section 5.6.2. Note that nonce-based replay protection is an optional feature of this specification. Timestamp-based replay protection, the other hand, (Section 5.6.1) is a requirement of this	those who in Section optional	
4029 4030 4031 4031		specificacion.	acton.			
4034	Perkins	ins		Standards Track	[Page 72]	
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KFC 2002	IP Mobility Support	October 1996
start mechan those mechan by the link discontinui been analyzi available, available, all correspi this documen transparency outside the designs whit	those mechanisms [9] designed for controlling that problem. However those mechanisms are inappropriate for overcoming errors introduced by the links themselves, and have the effect of magnifying the discontinuity introduced by the dropped packer. This problem has been analyzed by Cacrees, et al. [3]; there is no easy solution all correspondent nodes. While this problem is beyond the scope of transparency to mobile nodes involves understanding mechanisms outside the network layer. It also indicates the need to avoid designs which systematically drop packets; such designs mich avoid designs which systematically drop packets; such designs mich cherwise be considered favorably when making engineering tradeoffs	at problem. However, g errors introduced magnifying the This problem has o easy solution e installed soon on beyond the scope of performance ing mechanisms e need to avoid debesigns might gineering tradeoffs.
D. Example Scenarios This section show scenarios.	or	several common
The mobile of and wishes of agent care-cencapsulations simultaneous	The mobile node receives an Agent Advertisement from a foreign agent and wishes to register with that agent using the advertised foreign agent care-of address. The mobile node wishes only IP-in-IP encapsulation, dees not want broadcasts, and does not want simultaneous mobility bindings:	foreign agent ised foreign in-IP
IP fields: Source Ad Destinati Agent A Time to L UDP fields: Source Po Source Po Sestinati Registratio	If fields: Source Address = mobile node's home address Destination Address = copied from the IP source address Agent Advertisement Time to live = 1 UDP fields: Source Port = 4any> Destination Port = 434 Registration Request fields:	iddress of the
Type = 1 S=0.B=0,I Lifetime Nobilit Router Home Addr Home Ager Care-of P Mobilit Router Identific Extensions:	Yee = 1 Yee = 1 Lifetime = the Registration Lifetime copied from the Mobility Agent Advertisement Extension of the Nouter Advertisement message Home Address = the mobile node's home address Home Agent = IP address of mobile node's home agent Care-of Address = the Care-of Address copied from the Mobility Agent Advertisement Extension of the Router Advertisement message Identification = Network Time Protocol timestamp or Nonce tensions:	the nt the or Nonce
Perkins	Standerds Track	[Page 74]
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Page 74

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May 13	May 13 1998 10:38:26	rfc2002.txt	Page 75	May 13 1998 10:38:26
	RFC 2002	IP Mobility Support Octobe	October 1996	4203 4204 RFC 2002
	. Registering with a	D.2. Registering with a Co-Located Care-of Address		4205   4206   4207 D.3. Deregistration
4153 T	The mobile node enter ugents. The mobile n or use as a co-locat	The mobile node enters a foreign network that contains no foreign againts. The mobile node obtains an address from a DHCP server [6] for use as a co-located care-of address. The mobile node sumorrs	1911 [6] rrts	
	off forms of encapsul RE), desires a copy loes not want simulta	lation (IP-in-IP, minimal encapsulation, an of broadcast datagrams on the home network uneous mobility bindings:	nd c, and	ï
	IP fields:			4215 Time to Live 4216 UNP fields:
4162	Destination Addre- Time to Live = 64	Source Address = Care-ol address obtained from DHCP server Tinetion Address = IP address of home agent Time to Live = 64	,	
4164 4165	UDP fields: Source Port = <	any>		Re
4166	Destination Port = 434 Registration Request fields:	t = 434 est fields:		
4168	Type = 1 S=0, B=1, D=1, M=1	, G=1		
4171	Lifetime = 1800 Home Address =	(seconds) the mobile node's home address		
4172	Home Agent = IP Care-of Address	None Agent = 1P address of mobile node's home agent Care-of Address = care-of address obtained from DHCP server	i.	422 Extensions:   4228 The Mobile-H
4175	Identification : Extensions:	<ul> <li>Metwork Time Protocol timestamp or Nonce</li> </ul>		4230 E. Applicability of Pr
4176	The Mobile-Home	The Mobile-Home Authentication Extension		4231 Caution is indicated
4178 4179 4180 4181 4182 4183				
4186 4188 4189 4190 4191				4241 4242 4244 4244 4245 4245
4192 4193 4195 4196 4196 41997 4199				4247 4248 4254 4251 4253 4253
4200 4201 4202 Perkins		Standards Track (Pac	Page 75)	4255 4256 4257 4257 4257
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May	/ 13 1998 10:38:26	rfc2002.txt	Page 76
4203	RFC 2002 16	IP Mobility Support Octo	October 1996
4207			
4210	ije mobile hode returns r addresses with its home a	returns home and wishes to deregister all carts home agent.	care-of
4212 4213 4214 4215	IP fields: Source Address = mob Destination Address Time to Live = 1	= mobile node's home address tress = IP address of home agent	
4216 4217 4218 4219	- 1   <any></any>	434	
4220 4221 4222	Type = 1 S=0,B=0,D=0,M=0,G=0 Lifetime = 0		
4224 4225 4225 4225 4226	tess = nt = IP nddress	= the mobile node's home address PP address of mobile node's home agent SSS = the mobile node's home address OH = Network Time Protocol timestamp or Nonce	Ð
4228	The Mobile-Home Aut	cenations: The Mobile-Home Authentication Extension	
4230	E. Applicability of Prefix Lengths Extension	engths Extension	
4232 4233 4233 4235 4237 4238 4238	Caution is indicated with the use of over wireless links, due to the irreq wireless transmitters. As a result, agents advertising the same prefix miconnectivity to prospective mobile no Extension SHOULD NOT be included in tin such a configuration.	Caution is indicated with the use of the Prefix Lengths Extension over wireless links, due to the irregular coverage areas provided by Witeless transmitters. As a result, it is possible that two foreign adpents advertising the same prefix might indeed provide different connectivity to prospective mobile nodes. The Prefix-Lengths Extension SHOULD NOT be included in the advertisements sent by agentin such a configuration.	sion ided by foreign rent y agents
4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4			
	Perkins	Standards Track (1	[Page 76]

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Page 78

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79 May 13 1998 10:38:2	4427							
Page 79								
	October 1996	ditor:			 L			[Page 79]
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riczuuz.txt	IP Mobility Support	tor's Address Questions about this memo can also be directed to the editor:	ų		The working group can be contacted via the current chair:		com	Standards Track
.30.20	ж 4	iress about this memo c	Charles Perkins Room H3-D34 T. 4 Watson Research Center 1BM Corporation 30 Saw Mill River Rd. Hawthorne, MY 10532	Work: +1-914-784-7350 Fax: +1-914-784-6205 EMail: perk@watson.ibm.com	ng group can be co	Jim Sulomon Motorola, Inc. 1301 E. Algonquin Rd. Schaumbury, IL 60196	Work: +1-847-576-2753 EMail: solomon@comm.mot.com	SFE
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May 13 1998 10:38:26	rfc2002.txt	Page 80
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